80/387/NP

NEW WORK ITEM PROPOSAL

	Proposer Secretary TC 80	Date of proposal 2003-11
	TC/SC TC 80	Secretariat UK
Classification according to IEC Directives Supplement, Table 1	Date of circulation 2003-11-14	Closing date for voting 2004-02-20

A proposal for a new work item within the scope of an existing technical committee or subcommittee shall be submitted to the Central Office. The proposal will be distributed to the P-members of the technical committee or subcommittee for voting, and to the O-members for information. The proposer may be a National Committee of the IEC, the secretariat itself, another technical committee or subcommittee, an organization in liaison, the Standardization Management Board or one of the advisory committees, or the General Secretary. Guidelines for proposing and justifying a new work item are given in ISO/IEC Directives, Part 1, Annex C (see extract overleaf). **This form is not to be used for amendments or revisions to existing publications.**

The proposal (to be completed by the proposer)

Title of proposal

Maritime navigation and radiocommunication equipment and systems - Automatic identification systems (AIS): Fixed AIS stations (AIS base station, limited AIS base station and AIS simplex repeater station) – Performance requirements, methods of testing and required test results

☒ Standard	☐ Technical Specification	☐ Publicly Available Specification

Scope (as defined in ISO/IEC Directives, Part 2, 6.2.1)

To specify the minimum safe performance requirements, methods of testing, and required test results of fixed AIS stations (AIS base station, Limited AIS base station and AIS simplex repeater stations), taking into account other associated International Standards and existing national standards as appropriate.

Note: The drafting group should avoid creating a legacy issue with existing fixed AIS stations, which were built and tested in compliance with IALA Recommendation A-124.

Purpose and justification, including the market relevance and relationship to Safety (Guide 104), EMC (Guide 107), Environmental aspects (Guide 109) and Quality assurance (Guide 102) . (attach a separate page as annex, if necessary)

With the rapid development of, and implementation of carriage requirements for AIS there is a pressing need to ensure AIS equipment meets specified standards for harmonization and operations. IMO SOLAS Chapter 5, Regulation 19, section 2.4.5 states that AIS shall exchange data with shore-based facilities, and it is imperative that these shore based facilities, i.e. the so-called fixed AIS stations (AIS base station, Limited AIS base station and AIS simplex repeater stations), are built, tested and installed to a standard that will ensure consistent and seamless transfer of information. The correct and efficient data transfer between fixed stations and mobile stations (Class A shipboard mobile stations, Class B shipboard mobile AIS stations, AtoN-AIS-stations, SAR airborne AIS stations) may not be guaranteed, if fixed AIS stations do not meet a standard that will fully correspond to the requirements laid out in Recommendation ITU-R M.1371-1 together with the appropriate IALA Technical Clarifications.

To respond to the requirement for AIS shore station and networking aspects, the 31st session of the IALA Council (December 2002) approved "Recommendation A-124 on AIS shore stations and networking aspects relating to the AIS service (version 1.0)". This recommendation, in its Part II, presently contains the functional definitions and test conditions for the fixed AIS stations. To ensure compliance for fixed AIS station implementation by industry, there is a need to provide guidance on the specifications for certification or type approval testing.

Primary beneficiaries of this standard will be competent authorities setting up fixed AIS stations as part of their AIS service to the mariners, and also marine electronics manufacturers and distributors.

Target date	for first CD Attached	for IS 2005 - 06
Estimated number of meetings 8	Frequency of meetings: 4 per year	Date and place of first meeting: TBA
Proposed working methods	☒ E-mail	☒ ftp

Relevant documents to be considered

First Committee Draft (excerpt from existing IALA Recommendation A-124 ed 1.1)
Recommendation ITU-R M.1371-1 together with IALA Technical Clarifications on Recommendation ITU-R M.1371-1 (latest edition)
IEC 61993-2 (Class A shipborne AIS station)
IEC 62287 (current project within TC80 WG8A; Class B mobile AIS station)

Relationship of project to activities of other international bodies

This work will be carried out jointly by IALA and IEC.
The existing IALA document will be used as a basis from which to work.

Liaison organizations	**Need for coordination within ISO or IEC**
IALA, CIRM	

Preparatory work

Ensure that all copyright issues are identified. Check one of the two following boxes

☒ A draft is attached for vote and comment ☐ An outline is attached

We nominate a project leader as follows in accordance with ISO/IEC Directives, Part 1, 2.3.4 (name, address, fax and e-mail): TBA Convenor is Jillian Carson-Jackson, e-mail: jillian.carson@wanadoo.fr

Concerns known patented items (see ISO/IEC Directives, Part 2)	**Name and/or signature of the proposer**
☐ yes If yes, provide full information as an annex ☒ No*	M.A. Rambaut

Patent issues to be further investigated

Comments and recommendations from the TC/SC officers

1) Work allocation
☐ Project team ☒ New working group ☐ Existing working group no:

2) Draft suitable for direct submission as
☒FORMCHECKBOX CD ☐ CDV ☐ Publication as a PAS

3) General quality of the draft (conformity to ISO/IEC Directives, Part 2)
☐ Little redrafting needed ☒ Substantial redrafting needed ☐ no draft (outline only)

4) Relationship with other activities
In IEC:
TC80 WG6 (Interfacing using IEC 61162 mechanisms)

In other organizations
IALA AIS, RNAV, VTS Committees

Remarks from the TC/SC officers

The P-members of TC 80 are requested to comment on the draft attached.

Elements to be clarified when proposing a new work item

Title

Indicate the subject matter of the proposed new standard.

Indicate whether it is intended to prepare a standard, a technical report or an amendment to an existing standard.

Scope

Give a clear indication of the coverage of the proposed new work item and, if necessary for clarity, exclusions.

Indicate whether the subject proposed relates to one or more of the fields of safety, EMC, the environment or quality assurance.

Purpose and justification

Give details based on a critical study of the following elements wherever practicable.

a) The specific aims and reason for the standardization activity, with particular emphasis on the aspects of standardization to be covered, the problems it is expected to solve or the difficulties it is intended to overcome.

b) The main interests that might benefit from or be affected by the activity, such as industry, consumers, trade, governments, distributors.

c) Feasibility of the activity: Are there factors that could hinder the successful establishment or general application of the standard?

d) Timeliness of the standard to be produced: Is the technology reasonably stabilized? If not, how much time is likely to be available before advances in technology may render the proposed standard outdated? Is the proposed standard required as a basis for the future development of the technology in question?

e) Urgency of the activity, considering the needs of the market (industry, consumers, trade, governments etc.) as well as other fields or organizations. Indicate target date and, when a series of standards is proposed, suggest priorities.

f) The benefits to be gained by the implementation of the proposed standard; alternatively, the loss or disadvantage(s) if no standard is established within a reasonable time. Data such as product volume of value of trade should be included and quantified.

g) If the standardization activity is, or is likely to be, the subject of regulations or to require the harmonization of existing regulations, this should be indicated.

If a series of new work items is proposed, the purpose and justification of which is common, a common proposal may be drafted including all elements to be clarified and enumerating the titles and scopes of each individual item.

Relevant documents

List any known relevant documents (such as standards and regulations), regardless of their source. When the proposer considers that an existing well-established document may be acceptable as a standard (with or without amendments), indicate this with appropriate justification and attach a copy to the proposal.

Cooperation and liaison

List relevant organizations or bodies with which cooperation and liaison should exist.

Preparatory work

Indicate the name of the project leader nominated by the proposer.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS- AUTOMATIC IDENTIFICATION SYSTEM -

AIS shore stations - Minimum operational and performance requirements - methods of test and required test results

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC XXX has been prepared by subcommittee XX, of IEC technical committee XX:

The text of this standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until _____. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS - AUTOMATIC IDENTIFICATION SYSTEM -

AIS shore stations - Minimum operational and performance requirements - methods of test and required test results

Part A – The AIS Base Station

1 Scope

[To be drafted]

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[To be drafted]

3 Symbols and abbreviations

[To be drafted]

4 Functional layout of an AIS Base station

The AIS base station needs to perform in accordance with the Recommendation ITU-R M.1371-1 and IALA's Technical Clarifications (latest edition) in order to maintain harmony with the AIS system requirements. If not adhered to, the AIS base station will most likely create an imbalance on the VDL.

Functional block diagram of an AIS base station

Figure 1 shows the functional block diagram of an AIS base station. The components within dotted lines or the input data in parentheses are optional.

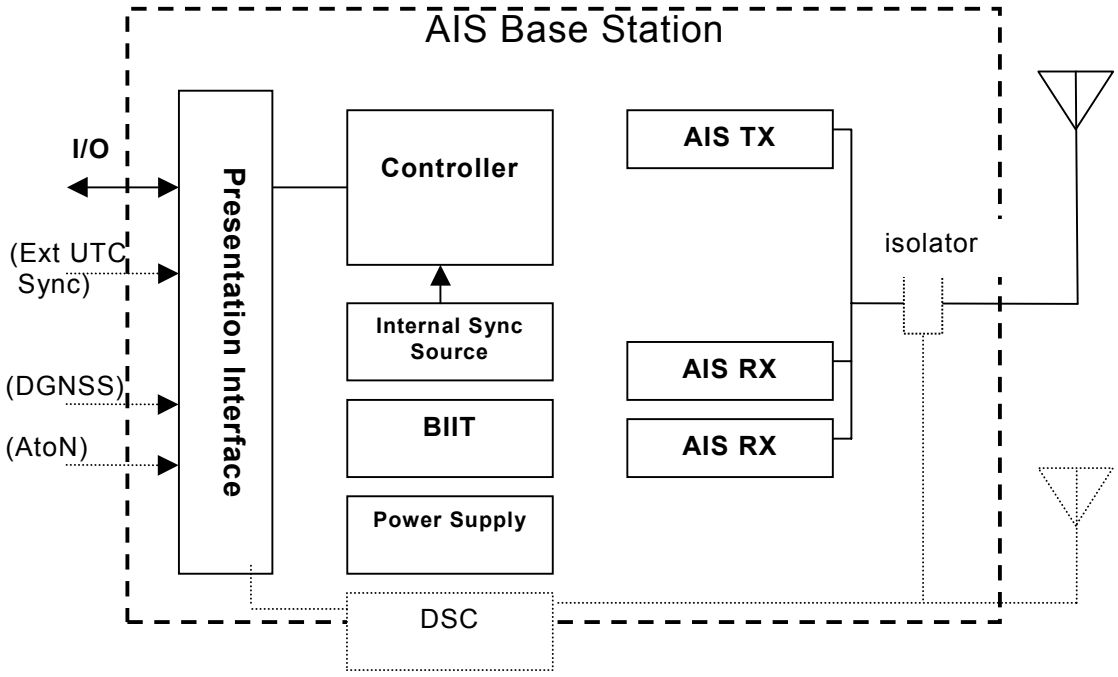


Figure 1: Functional block diagram of an AIS base station

The following functional elements are required in a minimum configuration of an AIS Base Station:

- **Two multi-channel receivers**
- **One multi-channel TDMA transmitter**: Since the minimum configuration of the AIS base station comprises only one transmitter, the AIS base station (in its minimum configuration) can not transmit on both AIS1 and AIS2 simultaneously.
- A **controlling unit**
- An **internal sync source** which may also be used as a position sensor for the AIS base station (see chapter on 'Requirements for Position Source of AIS Base Station')
- A **Built-In-Integrity-Test unit (BIIT)**
- A **power supply**
- A **Presentation Interface (PI)**: The Presentation Interface allows the output of data from the AIS base station to the physical shore station and to input data to the AIS base station. The PI also allows for input of DGNSS corrections for transmission by the AIS base station if provided in the PI message format

The following functional elements are optional to the AIS base station:

- **Additional receiver(s)**. For details on the operation of additional receivers see the appropriate chapter below;
- **Additional transmitter**. For details on the operation of an additional transmitter see the appropriate chapter below;

- **DSC functionality**, in which case the AIS base station would need some internal functionality to allow the internal DSC functionality to take effect in the operation of the AIS base station. The DSC functionality may be external to the AIS base station and should not interfere with TDMA functionality;
- **Input of DGNSS corrections** by a dedicated input port;
- **Aids-to-Navigation** VDL message transmission functionality (on behalf of physically existing AtoNs or as pseudo AtoNs).

4.1 General requirements for receivers and transmitters

The following general requirements apply to all receivers and transmitters:

- An AIS base station should use simplex channels or duplex channels in either full-duplex or half-duplex mode *[M.1371, Annex 1]*.
- An AIS base station should be capable of 25 kHz and 12.5 kHz emission / reception in accordance with ITU-R M.1084-2, Annex 3 (as referenced by Recommendation ITU-R M.1371-1).
- An AIS base station should not be required to be bandwidth agile during normal operation, however.

The transmitter should meet the following additional requirement:

- The AIS base station should be capable of transmitting using two different power settings, as provided for by *[1371-1]* and *[Clarifications]*, and the AIS base station should have the capability to set its power level as stipulated by an input command. The possible different power level settings are given in the appropriate chapter below.

The detailed requirements for receivers and transmitters are given in a chapter below

4.2 Configuration means

The AIS base station should provide the following configuration means as part of the minimum or as an option, as indicated.

- Configuration of the autonomous transmission of Base Station Reports (annex C CBM)
- Configuration of autonomous transmissions of Data Link Management Commands (FATDMA set-up) (annex C CBM)
- Configuration of autonomous transmission of Channel Management Commands (Frequency channel set-up) (annex C CBM)
- Configuration of radio parameters (annex C BCF)
- Configuration of transmission of DGNSS corrections (optional functionality) (annex C CBM)

4.3 BIIT minimum requirements

The functionality of the BIIT unit of the AIS Base Station should comprise the following alarms as a minimum. For details see the appropriate chapter below.

- TDMA Tx malfunction
- TDMA Antenna VSWR exceeds limit
- TDMA Rx 1 malfunction
- TDMA Rx 2 malfunction
- DSC Rx channel 70 malfunction – subject to DSC implementation (option)
- DSC Antenna VSWR exceeds limit - subject to DSC implementation
- DSC Tx channel 70 malfunction – subject to DSC implementation

5 Functional Definition of the Radio Interface of the AIS Base Station

The physical layer of the AIS base station should be designed in accordance with the following minimum requirements.

A base station that can transmit and receive simultaneously, if full duplex mode has been provided. Duplex channels in accordance with ITU-R M1084-3 should be used for this purpose. It should be noted that no system capacity would be gained in this mode. The only advantage over normal simplex mode is that while transmitting, transmissions on other channels will not be lost for this base station.

5.1 General Requirements of the Physical Layer

The following Table is derived from Recommendation ITU-R M.1371-1 (together with appropriate IALA Technical Clarifications).

Table 1 indicates how any given paragraph of Recommendation ITU-R M.1371-1 (together with appropriate IALA Technical Clarifications), which is indicated by the paragraph number, applies to the AIS base station. When there are sub-paragraphs, the symbol '@' indicates, that the requirement also includes all subparagraphs. The meaning of the column indications is:

'C' compulsory;

'N' not allowed;

'R' recommended;

'O' optional.

Table 1. - Mapping of Functionality of Recommendation ITU-R M.1371-1 (together with appropriate Technical Clarifications) to AIS base station

Annex/ Para of M.1371-1	Short description	LBS				Base Station				Remarks
		C	N	R	O	C	N	R	O	
A2, 2	***Physical layer***	**x**				**x**				
A2, 2.1.1 A2, 2.1.2 A2, 2.1.3	Physical layer, Parameters, General, Constants and Bandwidth except Table 2 PH.TXP	**X**				**X**				
A2, 2.1.1	Table 2 PH.TXP High setting of transmit output power	**X**				**x**				
	Table 2 PH.TXP Low setting of transmit output power	**X**				**x**				
A2, 2.1.4	Transmission media	**X**				**x**				
A2, 2.1.5	Dual channel operation, 2 receivers	**X**				**x**				
	Transmission on 2 frequencies	**X**				**x**				
A2, 2.2	25 kHz or 12.5 kHz setting	**x**				**x**				
A2, 2.3	Transceiver characteristics	**x**				**x**				
A2, 2.4 @	Modulation scheme	**x**				**x**				
A2, 2.5	Data transmission bit rate	**x**				**x**				
A2, 2.6	Training sequence	**x**				**x**				
A2, 2.7	Data encoding	**x**				**x**				
A2, 2.8	Forward error correction	**x**				**x**				
A2, 2.9	Interleaving	**x**				**x**				
A2, 2.10	Bit scrambling	**x**				**x**				
A2, 2.11	Data link sensing	**x**				**x**				
A2, 2.12 @	Transmitter settling time	**x**				**x**				
A2, 2.13@	Transmitter power high or low	**x**				**x**				
A2, 2.14 @	Shutdown procedure within 1.0 sec	**x** 1				**x** 1 a				1) If there is no DSC component then shutdown requirement shall be reduced to 0,5 sec 1a)An AIS Base Station with internal DSC functionality should shut down the transmission after 1.1 seconds.
A2, 2.15	Safety precautions	**x**				**x**				

5.2 Required Parameter Settings for the Physical Layer of the AIS Base Station

Tables 2 to 4 are derived from Recommendation ITU-R M.1371-1, annex 2 and give the parameters required for an AIS Base Station. For the meaning of the symbols and additional information (footnotes) refer to the appropriate section of Recommendation ITU-R M.1371-1, annex 2.

Table 2. - Required parameter settings for an AIS base station (part 1)

Symbol	Parameter Name	Low setting	High setting
PH.RFR	Regional frequencies	156.025 MHz	162.025 MHz
PH.CHS	Channel spacing	12.5 kHz	25 kHz
PH.AIS1	AIS 1 (default channel 1)	161.975 MHz	161.975 MHz
PH.AIS2	AIS 2 (default channel 2)	162.025 MHz	162.025 MHz
PH.CHB	Channel bandwidth	Narrow	Wide
PH.BR	Bit rate	9 600 bps	9 600 bps
PH.TS	Training sequence	24 bits	24 bits
PH.TST	Transmitter settling time (Transmit power within 20% of final value, Frequency stable to within ± 1.0 kHz of final value)	≤ 1.0 ms	≤ 1.0 ms
PH.TXP	Transmit output power (± 20%)	2 Watt	12.5 Watt

In addition, the constants of the physical layer of the AIS base station should comply with the values given in the Tables 13.3 and 13.4.

Table 3. - Required Settings of Physical Layer Constants (part 2)

Symbol	Parameter name	Value
PH.DE	Data encoding	NRZI
PH.FEC	Forward error correction	Not used
PH.IL	Interleaving	Not used
PH.BS	Bit scrambling	Not used
PH.MOD	Modulation	Bandwidth adapted; GMSK/FM

Table 4 - Bandwidth dependant parameters of the Physical Layer of the AIS Base Station

Symbol	Parameter name	PH.CHB / Narrow	PH.CHB / Wide
PH.TXBT	Transmit BT-product	0.3	0.4
PH.RXBT	Receive BT-product	0.3/0.5	0.5
PH.MI	Modulation Index	0.25	0.50

5.3 Requirements and recommendations for the TDMA Receivers of the AIS Base Station

The technical characteristics as specified in table 5 should apply to the TDMA receivers. The requirements indicated by (*) are compulsory for all AIS Base Stations, while all other parameters are recommended as a minimum. They may be subject to further regional requirements.

Table 5 - Required and recommended receiver characteristics

Receiver Parameters	25kHz channels	12.5kHz channels

Receiver Parameters	25kHz channels	12.5kHz channels
Sensitivity **(*)**	20% PER for –107 dBm	20% PER for –98 dBm
Co-channel rejection	-10 – 0 dB	-18 – 0 dB
Adjacent channel selectivity	70 dB	50 dB
Spurious response rejection	70 dB	N/A
Intermodulation response rejection and Blocking	20 % PER	N/A

5.4 Shutdown Procedure for an AIS base station

The required value for the initiation of the shutdown procedure *[1371, A2, §2.14]* together with *[Clarification]* of the AIS base station is dependent on whether or not the AIS base station is equipped with the optional DSC functionality:

- **AIS base station *without* DSC functionality:** The AIS base station should shut down the TDMA transmitter after one (1) second.
- **AIS base station *with* optional DSC functionality:** The AIS base station should shut down the transmitter after 1.1 seconds.

Rationale: The maximum symbol DSC base station transmission is nominal 1 second (refer to Annex D for calculation).

6 Functional Definition of the Presentation Interface of the AIS Base Station

6.1 Overview

The Presentation Interface (PI) of an AIS base station consists of at least one input/output port. If the PI is supported by a combination of existing 61162-1 sentences and sentences as defined in Annex C.2. The purpose of the PI data port is to:

- Exchange VDL data with the shore station
- configure the base station
- enable real time control of the base station
- provide an output for BIIT alarms and status

Optionally there can be additional ports as part of the PI such as DGNSS input, UTC timing input, etc. These will be discussed in the appropriate sections of this document.

The messages of the PI are subdivided in following functional blocks (refer to figure 2).

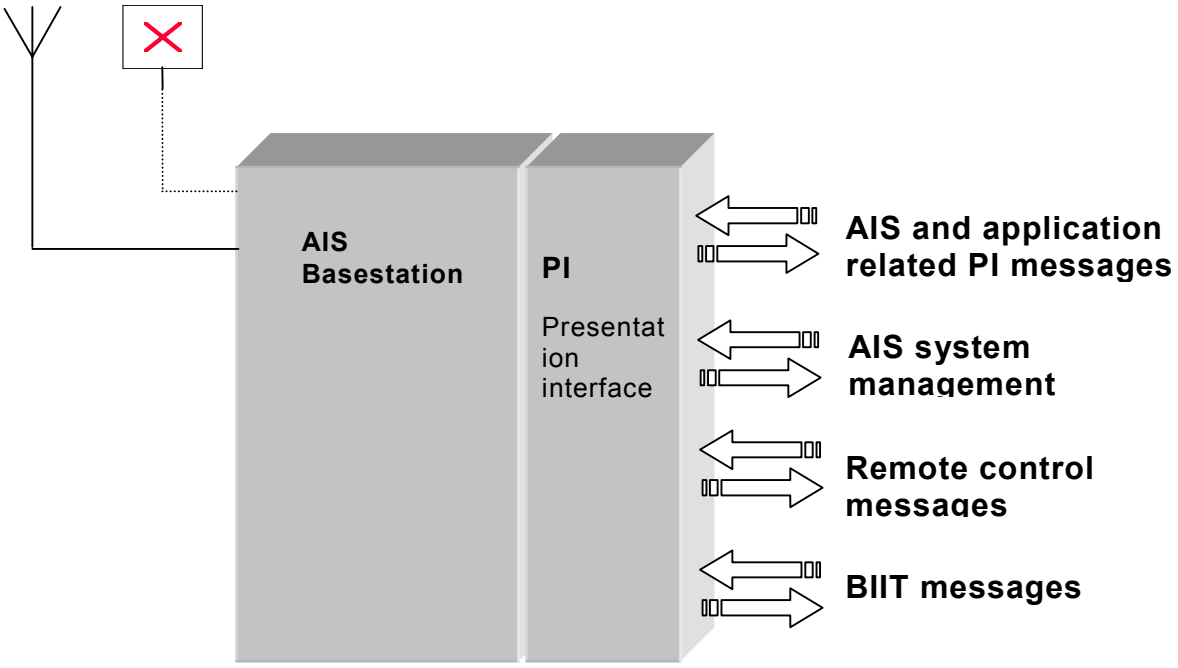


Figure 2: Functional blocks of PI messages

6.2 Physical Requirements for the Presentation Interface

The minimal requirement on the physical interface should be serial RS-232.

As an option, different physical interfaces may be provided such as:

- 10/100 BASE T
- USB

6.3 Output sentence format

Regardless of the physical interface implemented, the AIS base station should output data using the following sentence formats:

- Sentences identical to those used by Class-A shipborne mobile AIS stations in accordance with *[61162-1]*.
- Sentences which are specifically developed for an AIS base station. See Annex C.2
- Each output sentence is identified by the Talker Identifier (first two characters of an IEC 61162-1 sentence) as configured by the configuration sentence BCF.

6.3.1 IEC 61162-1 output sentences identical to those used in Class-A shipborne mobile equipment

Table 6 shows IEC 61162-1 output sentences, which are already in use for Class-A stations.

Table 6: Output sentences

Sentence	Comment
VDM	See table 15.6
VDO	See table 15.5
ABK	

Sentence	Comment
ALR	See table 15.7
TXT	See table 15.8

6.3.2 Use of VDO sentence by AIS base station

All transmitted VDL messages should be output by VDO sentences.
As an option, the slot number in which a VDL message was transmitted for each message could be provided.

6.4 Input sentence format

Regardless of the physical interface implemented, the AIS base station should receive data from the PI using the following sentence formats:

- Sentences identical to those used by Class-A shipborne mobile AIS stations in accordance with *[61162-1]*.
- Sentences which are specifically defined for input to an AIS base station. These sentences are defined in Annex C.2.

6.4.1 IEC 61162-1 input sentences identical to those used in Class-A shipborne mobile AIS stations

Table 7 shows IEC 61162-1 input sentences, which are already in use for Class-A stations.

Table 7 - Input sentences

Sentence	Comment
ACK	See IEC 61993-2
ABM	See IEC 61993-2
BBM	See IEC 61993-2
AIR	See IEC 61993-2
ACA	If the base station broadcasts message 22. For addressed messages see ACM
VDM	Refer to section below

6.4.2 Use of input VDM sentences for transparent transmission

For transmission, the AIS base station should use the VDL access scheme, which has the least impact on its use by other stations. It is recommended that the competent authority sets up a FATDMA access scheme for the AIS base station as a first priority. When using FATDMA access scheme, the slot, which should be used for transmission needs to be determined by the base station. When not using the FATDMA access scheme, the AIS base station should use RATDMA access scheme.

6.4.3 Sentences specifically defined to input data into AIS base station

The AIS base station should recognise and internally use, at least, the specifically defined input sentences as given in table 8. The full definitions of these input sentences are given in annex C.

Table 8 - Input sentences

Sentence	Full Name of Sentence
DLM	Data link management slot allocations for base station and mobiles
ASN	Preparation and initiation of an AIS base station broadcast of assignment VDL message 16
ACM	Preparation and initiation of an AIS base station broadcast of an addressed channel management message
BCF	Base station Configuration

Sentence	Full Name of Sentence
CBM	Configure base station message reporting rates
CAB	Control AIS base station

7 Limited Base Station (LBS)

7.1 Introduction

By the introduction of the AIS the IMO requests shipping industry to disclose and broadcast potentially sensitive information about ship movements, ship static and voyage related data.

In order to use the AIS in its area of competence a littoral or a port state needs to set up a national AIS Service in accordance with the appropriate technical standards created by ITU (Recommendation ITU-R M.1371-1) together with derived technical Recommendations issued by IALA. The most fundamental means to access the AIS VHF data link for a competent shore authority and thus provide the AIS Service is to deploy and operate AIS Base Station(s).

The AIS Service in a littoral or port state is operated by the national competent authority for the whole of the national coverage area. This national competent authority has the need to control the AIS Service and the AIS VHF data link, by employing means like channel management, protected slot allocations, and assigned mode. The AIS Base Station allows for the full control of the AIS VHF data link.

However, there are other competent authorities responsible for local operations of e. g. individual harbours, locks, marinas, off-shore structures. These regularly have an interest in monitoring the vessel traffic in their locally confined area of competence and exchange limited operational information with ships in regard to their area of competence, e. g. docking scheduling, tugs operation.

The uninformed use, the careless use or even the abuse of the powerful control mechanisms of the AIS Service – the so called Internal Basic AIS Services – may disrupt the AIS Service and may thus create an unstable AIS Service.

Using the powerful control mechanisms of the AIS Service may lead to liability issues.

In addition, the AIS Service is considered an Aid-to-Navigation, where special national legislation and / or regulations may apply.

Further, the AIS Service allows distributing navigational signals such as DGNSS corrections.

The national competent authority is in charge of the full AIS Service functionality, including the control mechanisms. However, to allow local competent authorities to participate in and benefit from the AIS Service, there are two possible options:

a) connect to the national AIS Service via a shore-based communication link,

b) establish their own locally confined AIS infrastructure with limited capacities.

To connect to the national AIS Service requires that the national AIS Service sets up a Logical AIS Shore Station (LSS) for the use of that particular local competent authority. The LSS can be configured to the needs of the local competent authority without requiring the local competent authority to bother with the intricate mechanisms of the AIS Service. The concept and details of setting up and interfacing to LSS are described in detail in the IALA “Recommendation on AIS Shore Stations and Networking Aspects Related to the AIS Services”.

By the same token the local competent authority may receive relevant information about ships from beyond its own area of competence, in particular ETA information.

Should the local competent authority be in need of tactical information on local ship movements or in situations where the national AIS Service does not provide coverage of that area, then the local competent authority could apply at the national competent authority to receive a concession to locally set up so called “LBS(s)” (LBS.).

These LBSs do not exhibit any means of controlling the AIS Service and the AIS VHF data link and to broadcast any navigational signals.

There is a requirement, though, that the operation of a LBS is co-ordinated with the national AIS Service in any case.

In addition, national regulations may apply. General overview on the capabilities and limitations of the LBS The LBS is capable of receiving all AIS messages within its radio range. In the case of addressed AIS messages the LBS only receives messages addressed to itself, however.

The LBS may transmit interrogation messages, binary and safety related messages. The LBS may also transmit acknowledgements to addressed messages.

If the optional Aids-to-Navigation functionality is added then the LBS may also transmit AtoN-reports.

The maximum permissible link utilization of a LBS is 20 slots per frame for all above messages except acknowledgements.

The LBS is prohibited to transmit any controlling or navigational messages such as assigned mode commands, DGNSS broadcasts and to perform data link management and channel management. The LBS also does not provide secondary synchronisation support, i. e. it is not acting as a semaphore.

Finally, any LBS are subject to the channel management messages (TDMA and DSC Channel 70) of the national AIS Service, if performed by the national AIS Service. Therefore, the LBS reacts like a mobile station in that it reacts to received Msg 22 and/or DSC-based AIS Channel Management command.

Due to the fact that the LBS by default does not transmit its own position / identification on a regular basis, in order to establish ship-to-shore communication the LBS must initiate this communication with the mobile station.

8 Comparison of LBS to Class A Mobile Station and Base Station

Table 9 presents the maximum capabilities of a LBS in comparison to the Class A Mobile Station and the AIS Base Station. LBSs that are less capable than that shown in Table 9 can be achieved by hardware or software configuration means.

Table 9 – LBS Comparison to Mobile Class A Station and Base Station

Msg ID	Description	Class A	LBS	Base Station
1	**SOTDMA Position Report**	Yes	nil	nil
2	**Assigned Position Report**	Yes	nil	nil
3	**ITDMA Position Report**	Yes	nil	nil

Msg ID	Description	Class A	LBS	Base Station
4	**Base Station static report**	nil	**Nil**	Yes
5	**Static Voyage Data**	Yes	nil	nil
6	**Binary Addressed Message**	Yes	Yes[1]	Yes
7	**Binary Addressed Ack**	Yes	Yes	Yes
8	**Binary Broadcast Message**	Yes	Yes[1]	Yes
9	**SAR Position Report**	nil	Nil	nil
10	**UTC/Date request**	Yes	**Nil**	Yes
11	**UTC/Date**	Yes	Nil	nil
12	**Safety Addressed Message**	Yes	Yes[1]	Yes
13	**Safety Addressed Ack**	Yes	Yes	Yes
14	**Safety Broadcast Message**	Yes	Yes[1]	Yes
15	**Interrogation**	Yes	Yes[1]	Yes
16	**Assigned mode command**	nil	Nil	Yes
17	**DGNSS broadcast**	nil	Nil	Yes
18	**Class B position report**	nil	Nil	nil
19	**Extended Class B position report**	nil	Nil	nil
20	**Data Link Management**	nil	Nil	Yes
21	**Aids-to-navigation report**	nil	**Yes**[1]	Yes
22	**Channel Management**	nil	Nil	Yes
[1] Total Link Load should be less than 20 slots per frame due to RATDMA access scheme. This applies to Binary Msgs (6, 8), Safety Messages (12, 14), Interrogation (15) and ATON Report (21).				

Other Rules and Limitations of LBS:

- No retransmission.
- AIS Msg 4 has been removed from LBS capabilities because it is a controlling message: Msg 4 can be either broadcast using FATDMA slots reserved by a higher competent authority or by the RATDMA access scheme. However, it cannot be assumed that a higher competent authority in the operational coverage area of the LBS is making FATDMA slot reservations. When using the RATMDA access scheme on the other hand the selected slots will become specially protected and cannot be reused by mobiles. Therefore, allowing Msg 4 to be broadcast by the LBS increases the random link load.

  The consequence of removing Msg 4 is that the LBS position information will not be broadcast. Yet the intentional slot reuse algorithm will function with all other messages transmitted by the LBS because the other messages do not have any specific base station slot protections.
- AIS Msg 21: There may be a liability issue for the LBS operating authority that applies only if optional ATON functionality is added to the LBS.
- The LBS should discard all addressed messages received that are not addressed to the LBS MMSI. The LBS may have more than one MMSI representing different services connected to the LBS.

9 Functional Definition of Internal Processing Functions of the AIS Base Station

This clause contains all requirements and describes the options with regard to the internal processing of the AIS Base Station.

9.1 Mapping of M.1371-1 to the AIS Base Station

9.1.1 Link Layer functionality as required / prohibited for AIS base stations

The following table maps the Link Layer paragraphs of Recommendation ITU-R M.1371-1 (together with appropriate sections of IALA Technical Clarifications) to the AIS Base station.

The following explanations apply for the following tables:

For the AIS Base Station, there are 4 columns showing the applicability, where '**x**' indicates that the section/paragraph is applicable. When there are sub-paragraphs, the symbol '@' indicates, that the requirement also includes all subparagraphs. The meaning of the 4 applicability columns is:

C Compulsory in any configuration

N Not allowed; must not be done or used or output

R Recommended, but not part of minimum requirements

O purely Optional

Legend for each message as described in *[M.1371,A2, 3.3.8.2.1…18]*:

G Generate the message and transmit

R Receive, process and internal use of the message

P Presentation interface output

T Transmit by repeater station after receiving it (repeat). This functionality is not allowed for AIS base stations

V Transmit if VDM sentence is received

Table 10 - Mapping of Link Layer

Annex, Para of M.1371-1	Short description	LBS				Base Station				Remarks
		C	N	R	O	C	N	R	O	
A2, 3	***Link layer***	**x**				**x**				
A2, 3.1	***Sublayer 1***	**x**				**x**				
	Medium Access Control (MAC)									
A2, 3.1.1	TDMA synchronisation, 1st paragraph	**x**				**x**				
	MAC SyncBaseRate		**x**			**x**				
	MAC SyncMobileRate		**x**				**x**			
A2, 3.1.1.1	UTC direct	**x**				**x**				
A2, 3.1.1.2	UTC indirect	**x**				**x**				
A2, 3.1.1.3	Synchronised to base station	**x**				**x** **1**				1) Although 3.1.1.3 is only applicable for mobile stations, a base station or an simplex repeater station should be allowed to synchronise to an(other)AIS Base Station
A2, 3.1.1.4	Number of received stations	**x**				**x**				
	except those being able to become semaphore									
	Can be a semaphore		**x**			**x**				
A2, 3.1.2	Time division	**x**				**x**				
A2, 3.1.3.1	Slot phase synchronisation	**x**				**x**				
A2, 3.1.3.2	Frame synchronisation	**x**				**x**				
A2, 3.1.3.3	Synchronisation Transmitting stations	**x**				**x**				
A2, 3.1.3.3.1	Base station operation		**x**			**x**				
A2, 3.1.3.3.2	Mobile station operation as a semaphore		**x**				**x**			
A2, 3.1.3.4 @ 3.1.3.4.3	Synchronisation Receiving stations	**x**				**x**				
A2, 3.1.4	Slot identification	**x**				**x**				
A2, 3.1.5	Slot access	**x**				**x**				
A2, 3.1.6	Slot state	**x**				**x**				
A2, 3.2	***Sublayer 2***	**x**				**x**				
@	Data link services (DLS)									
	except 3.2.2.11, Long transmission packets									
A2, 3.2.2.11	Long transmission packets	**x**				**x**				
A2, 3.3	***Sublayer 3***	**x**				**x**				
	Link management entity (LME)									
A2, 3.3.1 @	Access to data link	**x**				**x**				
A2, 3.3.2	Modes of operation	**x**				**x**				
A2, 3.3.2.1	Continuous		**x**			**x**				
	Autonomus	**x**				**x**				

Annex, Para of M.1371-1	Short description	LBS				Base Station				Remarks
		C	N	R	O	C	N	R	O	
A2, 3.3.2.2	Assigned		x				x 2			2) Base station can not be placed in the assigned mode via the VDL using msg 16. See also remark 5)
A2, 3.3.2.3	Polled		x			x				
A2, 3.3.3	Initialisation	x				x				
A2, 3.3.4	Channel access schemes	x				x				
A2, 3.3.4.1 @	ITDMA		x				x			
A2, 3.3.4.2 @	RATDMA	x				x				
A2, 3.3.4.3 @	FATDMA		x 3			x				3)Provide slot designation methods so FATDMA access can be an option
A2, 3.3.4.4 @	SOTDMA		x			x				4) refer to footnote (2) of A2, Table 13
						4				SOTDMA communication state operation stays as defined in 3.3.7.2.2, except when slot time out is 0, then slot off-set equals 2250.
A2, 3.3.5 @	Autonomous and continuous operation using SOTDMA		x				x 5			5) An AIS base station or an AIS Simplex repeater station is not operating in the autonomous mode
A2, 3.3.6 @	Assigned operation for mobile stations		x				x 6			6) According to this description, a base station or a repeater station may not be switched into assigned mode because they are not operating in the autonomous mode.
A2, 3.3.7	Message structure	x				x				
A2, 3.3.7.1	Message ID	x				x				
A2, 3.3.7.2 @	SOTDMA structure		x			x 4)				
A2, 3.3.7.3 @	ITDMA structure		x				x			
A2, 3.3.7.4 @	RATDMA structure	x				x				
A2, 3.3.7.5	FATDMA structure		x			x				
A2, 3.3.8	Message types	x				x				
A2, 3.3.8.1	Message summary	x				x				
A2, 3.3.8.2	Message description	x				x				
A2, 3.3.8.2.1	Message 1, 2, 3	R P	V G			R P V	G			
	Position report									
A2, 3.3.8.2.2	Message 4	R P	V G			G R P	V			
	Base station report									
	Message 11	R P	V G			R P	G V			
	UTC and data response									
A2, 3.3.8.2.3 @	Message 5	R P	V G			R P V	G			
	Ship static and voyage related data									
A2, 3.3.8.2.4 @	Message 6	G R P	V			G R P				7bis)Presentation Interface output only messages addressed to station MMSI
	Addressed binary message									

Annex, Para of M.1371-1	Short description	LBS				Base Station				Remarks
		C	N	R	O	C	N	R	O	
		7bis				V				
A2, 3.3.8.2.5	Message 7 Binary acknowledgement Message 13 Safety related acknowledgement	RPG	V			GRPV				
A2, 3.3.8.2.6	Message 8 Binary broadcast message	RPG	V			GRPV				
A2, 3.3.8.2.7	Message 9 Standard SAR Aircraft Position report	RP	GV			RPV	G			
A2, 3.3.8.2.8	Message 10 UTC time and data inquiry	RP	VG			GRP	V			
A2, 3.3.8.2.9	Message 12 Addressed safety related message	RGP7BIS	V			GRPV				
3.3.8.2.10	Message 14 Safety related broadcast message									
A2, 3.3.8.2.11	Message 15 Interrogation	R8bisGP	V			G8)RPV				8) refer to A 2, Table in § 3.3.8.2.11 8bis) LBS can not be interrogated
A2, 3.3.8.2.12	Message 16 Assigned mode command	R9P	VG			GR9PV				9) LBS and a base station can not be assigned by msg 16
A2, 3.3.8.2.13	Message 17 GNSS broadcast binary message	RP	VG			RPG10V				10) if implemented
A2, 3.3.8.2.14	Message 18 Standard CI B equipment position report	RP	VG			RPV	G			
A2, 3.3.8.2.15	Message 19 Extended CI B equipment position report	RP	VG			RPV	G			
A2, 3.3.8.2.16	Message 20 Data link management message	RP	VG			GRP	V			
A2, 3.3.8.2.17	Message 21 Aids-to-navigation report	RPG	V			RPV			G	

Annex, Para of M.1371-1	Short description	LBS				Base Station				Remarks
		C	N	R	O	C	N	R	O	
A2, 3.3.8.2.18	Message 22 Channel management	R P	V G			G **1** **0** **)** R **P** **V**				

9.1.2 Network Layer functionality as required / prohibited for AIS base stations

Table 11 maps the Link Layer paragraphs of Recommendation ITU-R M.1371-1 (together with appropriate sections of IALA Technical Clarifications) to the AIS Base station.

Table 11 - Mapping of Network Layer

Annex, Paragraph of M.1371-1	Short description	LBS				Base Station				Remarks
		C	N	R	O	C	N	R	O	
A2, 4	***Network layer***	x				x				
A2, 4.1	Dual channel operation	x				x 1 a 1 b				1a) for A2,§4.1: Receiving message 22 not applicable for AIS base station and AIS simplex repeater station; for A2, §4.1.1: Compulsory in general but channel selection is done by configuration sentences only. There is no requirement for storing received regional operating settings; for A2, §4.1.3: by configuration; for A2, §4.1.5: An AIS base station or an AIS simplex repeater should only operate in one designated area and should not be subject to move via transition to another area; for A2, §4.17 and §4.1.8: **not allowed** 1b) for A2, §4.1.4 : **Not allowed**; these rules apply for mobile AIS stations only.
A2, 4.1.1	Operating frequency channels	x				x 2)				2) Compulsory in general but channel selection is done by configuration sentences only. There is no requirement for storing received regional operating settings.
A2, 4.1.2	Normal default mode of dual channel operation	x				x				
A2, 4.1.3	Regional operating frequencies	x 3)				x				3) configuration
A2, 4.1.4	Regional operating areas		**x** **4**				**x** **4**			4)These rules apply for mobile stations only.
	DSC channel		x						**x** **5**	5) DSC channel management is optional for base stations
A2, 4.1.5	Transitional mode operations near regional boundaries		**x** **6)**				**x** 6			6) A base station should only operate in one designated area and should not subject be to move via transition to another area.
A2,4.1.5.1	Conditions for changing bandwidth only	**not applicable**				x				
A2, 4.1.6	Channel management switch by manual input	not applicable				not applicable				
A2, 4.1.7	Resumption of operation after power on		**x**				**x**			
A2, 4.1.8	Priority of channel management commands		**x**				**x**			

Annex, Paragraph of M.1371-1	Short description	LBS				Base Station				Remarks
		C	N	R	O	C	N	R	O	
A2, 4.1.9	Conditions for changing both AIS operational frequency channels	-	-	-	-	x				
A2, 4.2 @	Distribution of transmission packets, except 4.2.2.1 for AtoN position reports (optional)	x				x				
A2, 4.3	Reporting rates		x			x				
A2, 4.3.1 @	Autonomously changed reporting rate		**x**				**x**			
A2, 4.3.2	Assigned reporting rates		x				x			
A2, 4.4	Data link congestion resolution	x				x				
A2, 4.4.1	Intentional slot reuse by own station	x				x				
A2, 4.4.2	Use of assignment for congestion resolution		x			x				
A2, 4.5	Base station operation		x			x				Base station functions are not **additional** to mobiles
A2, 4.6	Repeater operation		**x**				**x**			
A2, 4.6.1.1	Repeat indicator (Mobile use)	--				--				
A2, 4.6.1.2	Repeat indicator (Base/repeater station use)				x?	x 7				7) Base station does not increase repeat indicator by repeating via received VDM sentence Base station should pre-set the repeat indicator to a value between 0 and 3, default=0 for generated messages. Simplex repeater station should increment the value of the repeat indicator as described in 4.6.1.2.1
A2, 4.6.1.2.1.	Number of repeats		**x**				**x**			
A2, 4.6.2	Duplex repeater mode		**x**				**x**			
A2, 4.6.3 @	Simplex repeater mode		**x**				**x**			
A2, 4.7	Handling errors related to packets	x				x				

9.1.3 Transport Layer functionality as required / prohibited for AIS base stations

Table 12 maps the Transport Layer paragraphs of Recommendation ITU-R M.1371-1 (together with appropriate sections of IALA Technical Clarifications) to the AIS Base station.

Table 12 - Mapping of Transport Layer

Annex, Paragraph of M.1371-1	Short description	LBS				Base station				Remarks
		C	N	R	O	C	N	R	O	
A2, 5.1	Transmission packet	x				x				

Annex, Paragraph of M.1371-1	Short description	LBS				Base station				Remarks
		C	N	R	O	C	N	R	O	
A2, 5.2 @	Conversion	x 1				x				1 LBS slot limitation of 20 slots/frame for sum of messages 6, 8, 12, 14, 15, 21 slots used
A2, 5.3.1	Addressed message	x				x				
A2, 5.3.2	Broadcast message	x				x				
A2, 5.3.3	Conversion to presentation interface	x				x				
A2, 5.4	Presentation interface protocol	x				x				
A3 @	***DSC***				x 2)				x 2)	2)May not be optional due to requirement of appropriate authorities in territorial waters
A4 @	***Long range***		**x**				**x**			
A5 @	***Application specific messages***	--				--				Application specific messages are put through transparently
A6 @	***Sequencing of transmission packets***	x				x				

9.2 Requirements for the internal processing of AIS VDL messages and PI sentences

The following sections describe the required functionality of an AIS Base Station with regard to internal processing of AIS VDL messages and PI sentences. For details of the PI sentence composition refer to annex C.

9.2.1 General Rules

The AIS Base Station should comply with the following general rules:

- The AIS base station should be able to receive all VDL messages
- The AIS base station should be able to generate and transmit any of the messages as given in table 13.

Table 13 - Base station messages

Msg ID	Message Name	Message Description
4	Base Station Report	Position, UTC, Date and current Slot number of base station
6	Binary Addressed Message	Binary data for addressed communication
7	Binary Acknowledgement	Acknowledgement of received addressed binary data
8	Binary broadcast message	Binary data for broadcast communication
10	UTC/Date inquiry	Request UTC and date
12	Addressed Safety Related Message	Safety related data for addressed communication
13	Safety Related Acknowledgement	Acknowledgement of received addressed safety related message

Msg ID	Message Name	Message Description
14	Safety Related broadcast Message	Safety related data for broadcast communication
15	Interrogation	Request for a specific message type (can result in multiple responses from one or several stations) (4))
16	Assignment Mode Command	Assignment of a specific report behaviour by competent authority using a base station
17	DGNSS Broadcast Binary Message	DGNSS corrections provided by a base station
20	Data Link Management Message	Reserve slots for base station(s)
21	Aids-to-Navigation Report	Position and Status Report for Aids-to-Navigation
22	Channel Management	Management of channels and transceiver modes by a base station

- The AIS Base Station should not filter data: Every received VDL message should be passed to the PI as a VDM sentence.
- Every received PI VDM sentence should be broadcast on the VDL.
- Every transmitted message on the VDL should be passed to the PI as a VDO sentence.
- The AIS Base Station should produce an “automatic response” when AIS Base Station detects its MMSI in VDL messages 10, 6, 12 or 15 and responds with messages 4, 7, 13 17, 20, 21 (if implemented), or 22 as appropriate.
- When configured accordingly, the AIS Base Station should periodically broadcast messages 4, 17, 20, and 22. For details of the configuration see appropriate sections below.

If configured, the AIS Base Station should periodically generate the Base Station Report (message 4), which is transmitted for reporting UTC time, date and position. The base station should normally transmit this message with a minimum reporting rate of 10 seconds. The base station should operate in this state until it detects one or more stations that are synchronising to the base station. It should then increase its update rate of msg 4 to 3 1/3 second (nominal) intervals, interleaved between both AIS channels. It should remain in this state until no stations have indicated synchronising to the base station for the last 3 minutes. FATDMA reserved slots are used for these transmissions. SOTDMA communication state operation stays as defined in ITU-R 1371-1, A2, 3.3.7.2.2, except when slot time out is 0, then slot off-set equals 2250. The Configuration Message (CBM) should be used to configure the msg 4 transmission schedule.

9.2.2 General message processing diagram

The AIS Base Station should internally process data in accordance with figure 3.

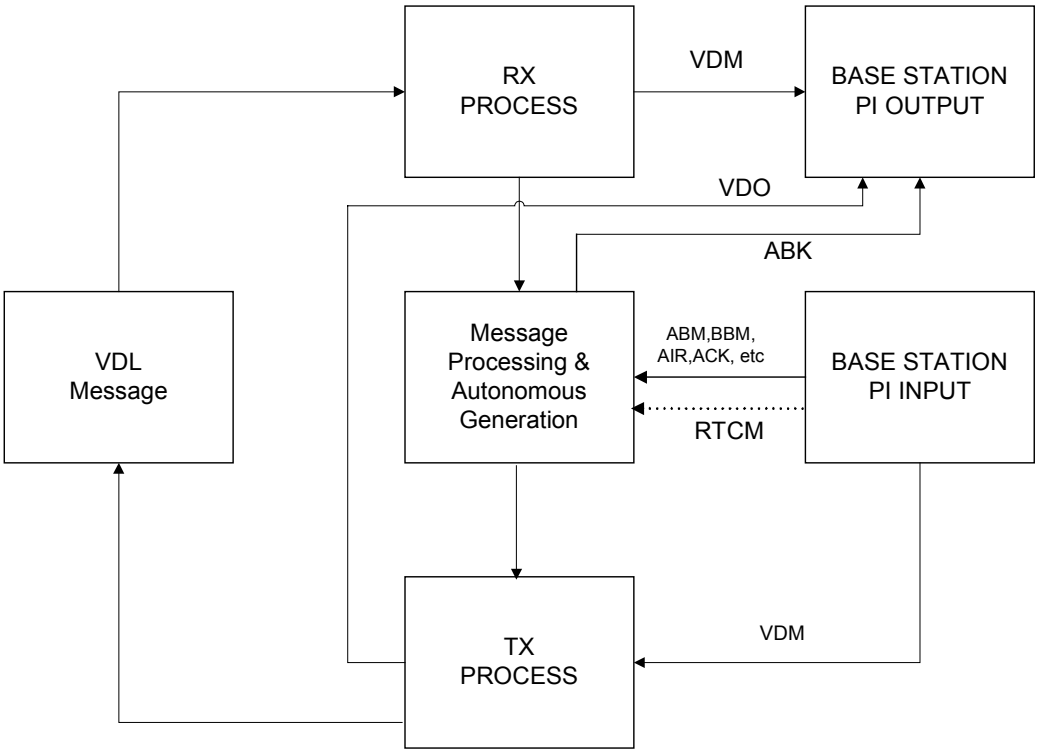


Figure 3 - General message processing diagram

9.2.3 AIS Base Station Response to PI Input

The AIS Base Station should response to input sentences from the PI in accordance with the Table 14.

Table 14 Response of an AIS Base Station to Input from the PI

PI Input	Resulting VDL Output	Resulting VDL reporting rate	Resulting PI Output
VDM [6]	Encapsulated message	Once	VDO
BCF	Message 4	once every 10 or 3-1/3 sec. [3]	VDO
ABM	Message 6 or 12	1 to 4 times	VDO, ABK
BBM	Messages 8 or 14	Once	VDO
AIR	Message 15	Once	VDO
ASN	Message 16	once [1]	VDO
RTCM[4]	Message 17	automatic and continiously[5]	VDO
DLM[7]	Message 20	automatic and continiously[2]	VDO
ACA	Message 22 (area)	automatic and continiously[2]	VDO
ACM	Message 22 (addressed)	Once	VDO

[1] external application (viz. VTS) needs a “monitor process” to maintain assignment.
[2] reporting rate needs to set by using CBM.
[3] reporting rate defined in ITU-R M.1371-1.
[4] this input is optional
[5] as long as the RTCM input is available
[6] for AtoN message 21 see chapter 17
[7] a DLM sentence reservation should not be applied if the “increment” field is not exactly one of the following: 0, 2, 3, 5, 6, 9, 10, 15, 18, 25, 30, 45, 50, 75, 90, 125, 150, 225, 250, 375, 450, 750, or 1125.

9.2.3.1 AIS base station response to VDM input

This section deals with VDM sentences received on the PI that must be transmitted on the VDL. Any external application returns processed messages via the PI using the VDM sentence for VDL retransmission. The base station should transmit the message without further data content processing.

The process of assembling the binary data to output on the VDL is similar to the process of assembling an encapsulated ABM or BBM. The difference is that the entire content is transmitted. See IEC 61993-2 for details.

The resulting VDL message should be transmitted in pre-reserved FATDMA slots. If FATDMA slots are not available RATDMA should be used.

9.2.4 AIS Base Station Response to VDL Input

When processing a received VDL message, the AIS Base Station should comply with the process lay-out in Figure 4:

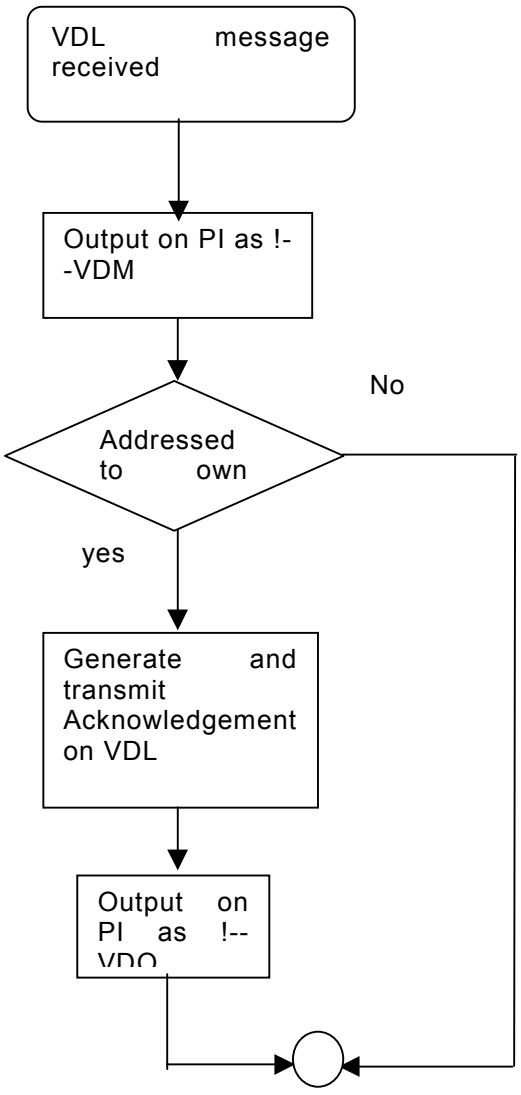


Figure 4 - AIS base station acknowledgement on VDL

The AIS Base Station should respond to input messages from the VDL in accordance with table 15. All received VDL messages should be output on the PI.

Table 15 - Base station respond to input messages from the VDL

VDL Input	Resulting PI Output	Resulting VDL Output	Resulting VDL reporting rate
Message 1	VDM	Nil	Nil
Message 2	VDM	Nil	Nil
Message 3	VDM	Nil	Nil
Message 4	VDM	Nil	Nil
Message 5	VDM	Nil	Nil
Message 6	VDM	Nil	Nil
Message 6 own MMSI	VDM, VDO (message 7)	Message 7	Once
Message 7	VDM	Nil	Nil
Message 7 own MMSI	VDM, ABK	Nil	Nil
Message 8	VDM	Nil	Nil
Message 9	VDM	Nil	Nil
Message 10	VDM	Nil	Nil
Message 10 own MMSI	VDM, VDO (message 4)	Message 4	Once
Message 11	VDM	Nil	Nil
Message 12	VDM	Nil	Nil
Message 12 own MMSI	VDM, VDO (message 13)	Message 13	Once
Message 13	VDM	Nil	Nil
Message 13 own MMSI	VDM, ABK	Nil	Nil
Message 14	VDM	Nil	Nil
Message 15	VDM	Nil	Nil
Message 15 own MMSI	VDM, VDO (message #)	Message 4, 17, 20, 21 (if implemented), or 22	Once
Message 16 [1]	VDM	Nil	nil
Message 17	VDM [2]	Nil	nil
Message 18	VDM	Nil	nil
Message 19	VDM	Nil	nil
Message 20	VDM	Nil	nil
Message 21	VDM	Nil	nil
Message 22	VDM	Nil	nil
Semaphore qualified	VDO	Message 4	3-1/3 seconds
Not Semaphore qualified	VDO	Message 4	10 seconds (see ITU-R M.1371-1 A2-3.1.3.3.1)

[1] Assume Base Stations never respond to Message 16.
[2] Assume no special conversion of differential corrections.

Each AIS Base Station should, as a default, be identified by its own individual MMSI. The AIS Base Station MMSI should be formatted following the ITU regulations *[210, 585]*:

00MIDxxxx

00 indicates the AIS Base/shore station identity

MID Maritime Identification Digits, reflecting the country in which the coast station is located

xxxx 4 digits 0-9 indicating one particular coast station

The AIS Base Station MMSI can be configured by means of a BCF sentence via the PI.

The AIS Base Station can transmit messages with a different identity provided by a higher level with means of standard VDM input sentences.

The AIS Base Station should, as a default, use a surveyed position (refer to Recommendation ITU-R M.1371-1, Annex 2, 3.3.8.2.2 – Table 16), if it is on a fixed position because the GNSS is not accurate enough. When using a surveyed position, the “Position accuracy” flag in VDL message 4 should be set upon configuration, and the “RAIM” flag should not be used (i.e. set to 0).

As an option, the AIS Base Station may use a position derived from an EPFD. In this case the following applies:

- The sensor information can be either from an external or internal source.
- If a GNSS source is used for position it should at least comply with the priority scheme laid out in IEC 61993-2 §6.10.3.4.
- A base station can use received messages 17 to correct its internal GNSS.

The AIS Base station should monitor the following BIIT conditions and should generate the appropriate alarm and warning sentences on the PI (see below). Some of the following BIIT conditions should be monitored only when the condition given is fulfilled.

Table 16 - BIIT Alarm conditions monitored by an AIS base station

alarms description text	Alarm condition threshold exceeded	Alarm condition not exceeded	alarm ID or text identifier	reaction of the system to the alarm condition threshold exceeded
AIS: Tx malfunction	A	V	001	Stop transmission
AIS: Antenna VSWR exceeds limit	A	V	002	Continue operation
AIS: Rx channel 1 malfunction	A	V	003	Stop transmission on affected channel
AIS: Rx channel 2 malfunction	A	V	004	Stop transmission on affected channel
AIS: Rx channel 70 malfunction [1]	A	V	005	Stop transmission on affected channel
AIS: general failure	A	V	006	Stop transmission
AIS: No sensor position in use	A	V	026	Continue operation
AIS: Frame synchronisation failure	A	V	037	Stop transmission
AIS: DGNSS input failed [2]	A	V	038	Continue operation
AIS: DSC Tx malfunction [2]	A	V	039	Stop DSC transmission
AIS: DSC antenna VSWR exceeds limits [2]	A	V	040	Continue operation

[1] If implemented

Table 17.-. BIIT Warning/Notification conditions monitored by an AIS base station

Text message	Text identifier	reaction of the system
AIS: UTC clock lost	007	Continue operation using indirect or semaphore synchronisation
AIS: external DGNSS in use	021	Continue operation
AIS: external GNSS in use	022	Continue operation
AIS: internal DGNSS in use (beacon)	023	Continue operation
AIS: internal DGNSS in use (msg 17)	024	Continue operation
AIS: internal GNSS in use	025	Continue operation
AIS: surveyed position in use	041	Continue operation
AIS: UTC clock OK	042	Continue operation

9.2.4.1 Optional Functionality to determine relevant physical values of a received VDL messages for each channel

As an option the AIS base station should be capable of determining:

a) The received signal strength for each message.

b) The first slot number of each received message.

c) The signal to noise ratio for each message.

d) The current channel load ratio for both VDL channels.

e) The hardware and software version information used in AIS base station.

When requesting this option from manufacturers, it should be noted that this might require a more expensive hardware addition.

Some of the options are related to individual Messages or slots, received by a Base station, some others are more general to gather information of the VDL channels or the Base Station itself. To make use of one of the options, the Base Station must be configured to send the required information by sending a BOC sentence to the Base Station. For details of the PI sentences of the options refer to Annex C2. Depending of the required information, the Base Station will reply with:

BRM sentence on option 1, 2 and 3

BRF sentence on option 4.

VER sentence on option 5.

The other options will be determined later.

Table 18: Response of an AIS Base Station to the optional Input from the PI

PI Input	Resulting VDL Output	Resulting reporting	Resulting PI Output
BOC, Message related configured option	Nil	Once per Message, directly after VDM	BRM

BOC, VDL related configured option	Nil	Once per Frame, Directly after Frame	BRF
BOC, Version request	Nil	Once after receiving BOC	VER

9.2.4.2 Requirements for the Sync Source

The AIS Base Station should use a UTC sync source. The UTC could be from an internal sync source. UTC can optionally come from an external sync source via a dedicated input port. The synchronisation source should have accuracy better than 104 µs.

9.2.5 Secondary synchronisation

When the UTC sync source is unavailable, the AIS Base Station should use UTC indirect (ITU-R 1371-1 A2, 3.1.1) or the semaphore rules (ITU-R 1371-1 A2, 3.1.1.4)

9.2.5.1 Requirements for management of mobile AIS stations by AIS Base Station

The following operational settings for mobile AIS stations can be controlled by an AIS Base station:

a) Regional Area Designation

b) Regional Working Frequencies Assignment

c) Power level

d) Bandwidth

e) Tx/Rx mode

f) Transitional zone size

When the DSC option is available and is used to send channel management messages, the transitional zone size will be fixed to 5 nautical miles.

The PI sentence ACA should be used to set up the Channel management information for the AIS base station with should result in transmission of Message 22: Channel Management.

9.3 Requirements for Acknowledgement / Retries Configuration

The number of retries for Addressed Messages as described in M.1371, A2, §5.3.1 is input by configuration PI sentence BCF.

9.4 Requirements for Assigned Mode Commands

Assignment commands should be transmitted by a base station when operating as a controlling entity. Mobile stations can be assigned a transmission schedule, other than the currently used one.

The message is intended to be used by the competent authority e.g. a VTS station to assign a different update rate for a specific vessel of interest[2].

The lowest reporting rate that can be assigned is 20 reports per 10 minutes.

The highest report rate that should be assigned is 1 per second.

Two mobile stations can be assigned simultaneously.

---

2 Class A mobile station reporting rates will not be lowered

Mobile station in a transitional zone will not obey

When receiving an assignment schedule, the mobile station will tag it with a timeout, randomly selected between 4 and 8 minutes after the first transmission.

Initiation and maintaining of assigned mode messages is not a responsibility of the base station but of a higher level. The higher level inputs via the PI will be done with the ASN sentence.

9.5 Requirements for Configuration of FATDMA Access Scheme (Link Management Message)

9.5.1 Required and Recommended Use of the FATDMA Access Scheme

Generally FATDMA access should be used; however, if necessary, RATDMA may be used to transmit non-periodic broadcasts. The AIS Base Stations should send Safety Messages using the reserved FATDMA access scheme.

A Base station report (message 4) does not require FATDMA slot reservation because it will, by default operate using SOTDMA (see 16.3) and is protected by the 120 nautical mile rule (see1371-1, A2, 4.4.1).

9.5.2 Requirements for Configuration of the Autonomous and Continuous Transmission of Data Link Management Messages

The Data Link Management Message (message 20) should be used by base station(s) to pre-announce the fixed allocation schedule (FATDMA) for one or more base station(s) and it should be repeated as often as required. This way the system can provide a high level of integrity for base station(s). This is especially important in regions where several base stations are located adjacent to each other and mobile station(s) move between these different regions.

The Data Link Management Message is a continuously scheduled and transmitted message. The base station should refresh the time-out value with each transmission in order to allow mobile stations to terminate their reservation for the use of the slots allocated by the base station (refer to ITU-R M.1371-1, A2, § 3.3.1.2, together with appropriate Technical Clarifications).

Since FATDMA slot reservations are valid only for a randomly selected time (between 4 to 8 minutes), the AIS Base Station should use the CBM sentence to schedule the autonomously and continuously transmission of Data Link Management Messages, which refresh the FATDMA reservations.

The Data Link Management message applies only to the frequency channel on which it is transmitted.

If the AIS Base Station is interrogated and no data link management information available, only Offset number 1, number of slot offsets 1, time-out 1, and increment 1 should be sent. These fields should all be set to zero.

9.6 Requirements for the Preset of the Repeat-Indicator

The AIS Base Station should preset the repeat indicator for own transmissions of all VDL messages to a value between 0 and 3[3] in accordance with Recommendation M1371-1, A2, 4.6.1.2 (together with appropriate Technical Clarifications) as configured by an external command (see BCF sentence). If no configuration was received, the AIS Base Station should use the default value of zero (0).

It is only applicable for messages generated by the base station.

[3] By pre-set the repeat indicator by non zero this disqualifies the base station from becoming an indirect sync source

9.7 Requirements for the optional transmission of DGNSS corrections

AIS should derive its correction data from an integrity monitored DGNSS reference station or from existing MF beacon DGNSS broadcasts wherever possible, to ensure integrity and minimise infrastructure costs.

Occupancy of AIS channels by DGNSS broadcasts should be acceptable as long as a single correction source is used.

There are two possible ways to accept DGNSS corrections for transmission:

- As a result of a VDM sentence via the PI. All required information for transmission is included in the VDM sentence
- Via the dedicated optional DGNSS input port. In addition to the correction data, the surveyed position of the reference station must be obtained via this port

Transmission of message 17 should be integrity monitored according to IALA Guidelines. This can be done on the Physical or the Logical AIS Shore Station Level and should not be a requirement of the AIS Base Station.

The considerations proper are contained in annex B.

9.8 Requirements for the optional DSC functionality of an AIS Base station

When an AIS Base station is using the optional DSC functionality it should follow the same rules as in *[M.1371, Annex 3]* and the *[TechClar].* Guidelines for the operation of the DSC functionality in an AIS base station are given below.

DSC transmissions by a base station should only be done on channel 70. Mobile AIS stations can respond on different working channels as instructed by the base station as long as this does not interfere with the AIS TDMA channels.

If required, the DSC functionality is recommended as a modular addition to the AIS Base Station. This method of implementation should be more cost effective and allow for easy updating of technology. However, the DSC front end (Tx/Rx) should not be integrated into the AIS TDMA front end.

For further guidance on the technical operation of the DSC functionality, refer to the chapter on ‘Guidelines for the use of DSC-capabilities with regard to the AIS’ in Part III-B (AIS Shore Station Operation).

9.9 Ramifications of employing additional (optional) receivers and/or transmitters

Additional receivers and a second transmitter should be an option. If more than two transmitters are required, an additional base station is needed.

The benefits of using additional receivers and transmitter are:

- Additional receivers can be used for improving the AIS VHF coverage.
- The additional transmitter can be used to increase the broadcast bandwidth and capacity.
- Additional receivers and the second transmitter can be seen as a form of redundancy.

9.10 Requirements for optional remote firmware update for AIS base station

If remote firmware update for the AIS base station is implemented, it should be referred to in the manufacturer's documentation, taking into account the regulations for security (passwords etc).

10 AIS AtoN functionality

As an option an AIS base station may transmit message 21 (AtoN report). The message will be initiated via the PI with a VDM sentence from an external process.

11 Regional specifications

This document describes general specifications of AIS base stations only. Local regulations may be applicable in regions or countries. However, they should not conflict with the requirements set out in *[M.1371]* and *[TechClar]*.

A competent authority should not assign different bandwidths to adjacent regions using the same frequency. Such assignments would result in an unstable condition with regard to received messages, incorrectly interpreting slots as being free.

12 Tests of AIS Base stations- method of measurement and required results

12.1 General

Physical test parameters and testing subject to national requirements and may override parameters stated below. These parameters are stated as a guideline only.

Reference to IEC 61162 sentences are made in throughout this section.

In a future edition, this section will contain a section with regard to proof of certification.

12.2 Test conditions

12.2.1 Normal test conditions

12.2.1.1 Temperature and humidity

Temperature and humidity shall be within following range:

Temperature	+15° to +35° C
Humidity	20% to 75%

12.2.1.2 Power supply

The normal power supply for the tests shall be in accordance with local safety regulations concerning power supply e.g. IEC 60950 as applicable in many countries.

12.2.2 Extreme test conditions

Extreme test conditions are as specified in IEC 60945. Where required, tests under extreme test conditions shall be a combination of:

- dry heat and upper limit of supply voltage applied simultaneously, and
- low temperature and lower limit of supply voltage applied simultaneously.

During type testing the power source to the equipment may be replaced by a test power source, capable of producing normal and extreme test voltages.

12.2.3 Standard Test environment

The EUT is tested in an environment using test equipment to simulate and to log VDL-messages (see annex A). Standard environment consists of at least 5 simulated targets. The signal input level at the RF input port of the EUT for any simulated target shall be at least –100 dBm. Own position sensor inputs to EUT will be simulated by the test system or other means. Operation is checked on channels in the maritime mobile band.

Channels in use shall be selected by manual input before starting test.

12.2.4 Test Signals

12.2.4.1 Standard Test Signal Number 1

A DSC call with an individual station address and with command sets 103 (report your position) and 111 (report ship name) unless otherwise stated (refer to ITU-R M.825).

12.2.4.2 Standard Test Signal Number 2

For TDMA Type 1: A test signal consisting of an infinite series of 010101

12.2.4.3 Standard Test Signal Number 3

For TDMA Type 2: A test signal consisting of an infinite series of 00110011.

NOTE : Transmitters may have limitations concerning their maximum continuous transmit time and/or their transmission duty cycle. It is intended that such limitations are respected during testing.

12.2.5 Arrangements for test signals applied to the receiver input

Sources of test signals for application to the receiver input shall be connected in such a way that the source impedance presented to the receiver input is 50 Ω (See 18.2.8).

This requirement shall be met irrespective of whether one or more signals using a combining network are applied to the receiver simultaneously.

The levels of the test signals at the receiver input terminals (RF socket) shall be expressed in terms of dBm.

The effects of any intermodulation products and noise produced in the test signal sources shall be negligible.

12.2.6 Encoder for receiver measurements

Whenever needed and in order to facilitate measurements on the receiver, an encoder for the data system shall accompany the EUT, together with details of the normal modulation process. The encoder is used to modulate a signal generator for use as a test signal source.

Complete details of all codes and code format(s) used shall be given.

12.2.7 Waiver for receivers

If the manufacturer declares that both TDMA receivers are identical, the test shall be limited to one receiver and the test for the second receiver shall be waived. The test report shall mention this.

12.2.8 Impedance

In this standard the term "50 Ω" is used for a 50 Ω non-reactive impedance.

12.2.9 Artificial antenna (dummy load)

Tests shall be carried out using an artificial antenna, which shall be a non-reactive non-radiating load of 50 Ω connected to the antenna connector.

NOTE: Some of the methods of measurement described in this standard for the transmitters, allow for two or more different test set ups in order to perform those measurements. The corresponding figures illustrate therefore one particular test set up, and are given as examples. In many of those figures, power attenuators (providing a non-reactive non-radiating load of 50 Ω to the antenna connector) have been shown. These attenuators are not "artificial antennas" as defined in 12.2.9. The method of measurement used shall be stated in the test report.

12.2.10 Facilities for access

All tests shall be performed using the standard ports of the EUT. Where access facilities are required to enable any specific test, these shall be provided by the manufacturer.

12.2.11 Modes of operation of the transmitter

For the purpose of the measurements according to this standard, there shall be a facility to operate the transmitter unmodulated.

Alternatively, the method of obtaining an unmodulated carrier or special types of modulation patterns may also be decided by agreement between the manufacturer and the test laboratory. It shall be described in the test report. It may involve suitable temporary internal modifications of the equipment under test. For instance in the case of direct Frequency Shift Keying (FSK), a means to continuously transmit a sequence containing only "zeros" and a sequence containing only "ones" is preferable.

12.2.12 Measurement uncertainties

Maximum values of absolute measurement uncertainties shall be as follows:

RF frequency	± 1 x 10^{-7}
RF power	± 0.75 dB
Adjacent channel power	± 5 dB
Conducted spurious emission of transmitter	± 4 dB
Conducted spurious emission of receiver	± 3 dB
Two-signal measurement	± 4 dB
Three-signal measurement	± 3 dB
Radiated emission of transmitter	± 6 dB
Radiated emission of receiver	± 6 dB
Transmitter attack time	± 20 %
Transmitter release time	± 20 %
Transmitter transient frequency (frequency difference)	± 250 Hz

For the test methods according to this standard, these uncertainty figures are valid to a confidence level of 95 %.

The interpretation of the results recorded in a test report for the measurements described in this standard shall be as follows:

a) the measured value related to the corresponding limit shall be used to decide whether an equipment meets the requirements of this standard;

b) the actual measurement uncertainty of the test laboratory carrying out the measurements, for each particular measurement, shall be included in the test report;

c) the values of the actual measurement uncertainty shall be, for each measurement, equal to or lower than the figures given in this clause (absolute measurement uncertainties).

12.3 E M C tests

These tests must be performed in accordance with the appropriate land base standards.

13 Functional tests

13.1 Operating modes / Capability

13.1.1 (M.1371 A2/3.3.5) Normal Operation

13.1.1.1 (16.3 M.1371 A2/3.3.8.2.2) Base station report

13.1.1.1.1 Information content

Method of measurement

Set-up standard test environment and operate EUT in normal mode.

a) Apply necessary data by configuration or external input (MMSI, UTC, position, type EPFD) to the EUT.
b) Simulate unavailable or invalid sensor data.
c) Apply a non WGS84 or unspecified (no DTM) position input.
d) Apply a low accuracy position input (e.g. GNSS uncorrected).

Record all messages on VDL and check the contents of base station report msg 4.

Required results

a) Confirm that data transmitted by the EUT complies with manual and sensor inputs.
b) Confirm that data which is not available or invalid is set to default.
c) Confirm that only WGS84 data is used for transmission.
d) Confirm that accuracy field is set to “0”.

13.1.1.1.2 (M.1371 A1/4.2.1) Reporting rates

Method of measurement

Set-up standard test environment and operate EUT in normal mode.

Record the transmitted messages and check for base station report (msg 4).

Required results

Confirm that the EUT transmits msg 4 with a reporting rate of 10 sec.

13.1.1.2 Receive Messages

Method of measurement

Set up a test environment of at least 5 test targets.

a) Switch on Test targets, then start operation of the EUT
b) Start operation of the EUT, then switch on Test targets

Check the VDL communication and Presentation Interface outputs of the EUT.

Required results

Confirm that EUT receives continuously under conditions a) and b) and outputs the received messages via the PI.

13.1.2 (M.1371A2/3.3.6) Assigned mode

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Transmit an PI sentence ASN with the following to the EUT:

a) Slot offset and increment
b) Designated reporting rate.

Record transmitted messages.

Required results

Confirm that the EUT transmits the Assigned command msg. 16 to the designated Mobile Unit

13.1.3 (M.1371A2/3.3.2) Polled mode

13.1.3.1 Transmit an interrogation

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Initiate the transmission of an interrogation message (msg 15) by the EUT addressing 1 or 2 destinations according to message table (M.1371 table13) requesting the following responses :

- msg 3, msg 5 from mobile stations

Record transmitted messages.

Required results

Check that EUT transmits the interrogation message (msg 15) as appropriate.

13.1.3.2 Interrogation response

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Apply an interrogation message (msg 15; EUT as destination) to the VDL according to the message table (M.1371 table13) for responses with msg. 4, msg. 17, msg. 20 and msg. 22 as requested. Record transmitted messages and frame structure.

Required results

Check that the EUT transmits the appropriate interrogation response message as requested. Confirm that the EUT transmits the response on the same channel as where interrogation was received.

13.1.4 (M1371 A2/3.3.8) Addressed operation

13.1.4.1 Transmit an addressed message

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Initiate the transmission of an addressed binary message (msg 6; EUT as source) according to message table (M.1371 table13) by the EUT. Record the transmitted messages.

Required results

Check that the EUT transmits the msg 6 as appropriate. Repeat test with the addressed safety related message (msg 12).

13.1.4.2 Receive addressed message

Method of measurement

Set-up standard test environment and operate EUT in normal mode.

a) Apply an addressed binary message (msg 6; EUT as destination) to the VDL.
b) Apply an addressed binary message (msg 6; other station as destination) to the VDL.

Record transmitted messages and frame structure.

Required results

Check that EUT transmits the appropriate acknowledgement message. Confirm that

a) EUT outputs the received message via the Presentation Interface.
b) EUT does not output the received message via the Presentation Interface.

13.2 (M.1371 A2/5.2.1) Multiple slot messages

13.2.1 5 slot messages (M.1371 A2 / 5.2.1)

Method of measurement

Apply a BBM sentence to the PI of EUT with a max. of 121 data bytes of binary data in order to initiate transmission of a binary message (msg 8).

Required results

Check that the message is transmitted in up to 5 slots accordingly.

13.2.2 Longer messages (M.1371 A2 / 5.2.1)

Method of measurement

Apply a BBM sentence to the PI of the EUT Presentation Interface with an information content not fitting in 5 slots (i.e. more than 121 data bytes of binary data containing only binary 1’s).

Required results

Check that the message is not transmitted. Check that a negative acknowledgement is given on the presentation interface.

13.3 (ITU-R M.1371 A2/3.3.3) Initialisation period

Method of measurement

Set up standard test environment with relevant sensors available.

a) Switch on EUT with EUT operating in normal mode.

b) Switch off EUT for approx. 0.5 s. Record transmitted messages.

Required results

Confirm that the EUT starts transmissions within [2] min after switch on.

13.4 Channel selection

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Switch the EUT to different channels randomly selected from the maritime mobile band as specified by ITU-R M.1084-4, Annex 4 using both 25kHz and 12.5kHz channel spacing (incl. 12.5kHz emission on a 25kHz channel): by application of BCF sentence to the presentation interface.

Record the VDL messages.

Required results

Confirm that the EUT switches to Channel / bandwidth and duplex / simplex channels accordingly.

13.5 (M.1371 A2/2.14, 2.15) Transceiver protection

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Open circuit and short circuit VHF-antenna terminals of the EUT for at least 60 s each.

Required results

The EUT shall be operative again within 2 min after refitting the antenna without damage to the transceiver.

13.6 Alarms and indicators (BIIT)

The functionality of the BIIT unit of the AIS Base Station should be comprised of the followings alarms as a minimum. For details see the appropriate chapter below.

Table 19 - Integrity alarm conditions signalled using ALR sentence formatter

alarms description text	Alarm condition threshold exceeded	Alarm condition not exceeded	alarm ID	reaction of the system to the alarm condition threshold exceeded

alarms description text	Alarm condition threshold exceeded	Alarm condition not exceeded	alarm ID	reaction of the system to the alarm condition threshold exceeded
AIS: Tx malfunction	A	V	001	Stop transmission
AIS: Antenna VSWR exceeds limit	A	V	002	Continue operation
AIS: Rx channel 1 malfunction	A	V	003	Stop transmission on affected channel
AIS: Rx channel 2 malfunction	A	V	004	Stop transmission on affected channel
AIS: Rx channel 70 malfuncti`on [4]	A	V	005	Stop transmission on affected channel
AIS: general failure	A	V	006	Stop transmission
AIS: No sensor position in use [5]	A	V	026	Continue operation
AIS: Frame synchronisation failure	A	V	037	Stop transmission
AIS: DGNSS input failed	A	V	038	Continue operation
AIS: DSC Tx malfunction	A	V	039	Stop DSC transmission
AIS: DSC antenna VSWR exceeds limits	A	V	040	Continue operation

Table 20 - BIIT Warning/Notification conditions monitored by an AIS base station

Text message	Text identifier	reaction of the system
AIS: UTC clock lost	007	Continue operation using indirect or semaphore synchronisation
AIS: external DGNSS in use[6]	021	Continue operation
AIS: external GNSS in use[7]	022	Continue operation
AIS: internal DGNSS in use (beacon) [8]	023	Continue operation
AIS: internal DGNSS in use (msg 17) [9]	024	Continue operation
AIS: internal GNSS in use [10]	025	Continue operation
AIS: surveyed position in use	041	Continue operation
AIS: UTC clock OK	042	Continue operation

[4] If implemented

[5] If implemented

[6] If implemented

[7] If implemented

[8] If implemented

[9] If implemented

[10] If implemented

13.6.1 (6.10.2) Monitoring of functions and integrity

13.6.1.1 Tx malfunction

Method of measurement

Disable the transmitter by disconnecting the antenna.

Required result

Verify that an alarm sentence ALR with alarm ID 001 is sent.

Verify that relay deactivates when the EUT receives an ACK and that the status field in the ALR sentence is updated.

13.6.1.2 Antenna VSWR

Method of measurement

Prevent the EUT from radiating with full power by mismatching the antenna for a VSWR of 3:1 .

Required result

Verify that the EUT continues transmitting. Verify that an alarm sentence ALR with alarm ID 002 is sent.

Verify that relay deactivates when the EUT receives an ACK and that the status field in the ALR sentence is updated.

13.6.1.3 Rx malfunction

Manufactures shall provide documentation describing how the AIS detects Rx malfunction and that an ALR sentence with alarm ID as appropriate is sent.

13.6.1.4 Loss of UTC

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Disconnect the GNSS antenna (UTC clock lost).

Required result

Verify that the system continues to operate but changes to indirect synchronisation and that an alarm sentence ALR with alarm ID 007 is sent.

13.7 Configuration means

The AIS base station should provide the following configuration means as part of the minimum or as an option, as indicated.

- Configuration of the normal transmission of Base Station Reports (msg. 4)
- Configuration of normal transmissions of Data Link Management Commands (FATDMA setup – msg. 20)

- Configuration of normal transmission of Channel Management Commands (Frequency channel setup – msg. 22)
- Configuration of radio parameters (Presentation Interface sentence BCF)
- Setting request
- Configuration of transmission of DGNSS corrections – msg. 17 (optional functionality)

Method of measurement

Set-up standard test environment and operate EUT in normal mode.

Required results

Confirm that base station is configurable and that it operates in accordance with the configuration.

13.8 Retransmission of VDM messages

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Input VDM message via presentation interface. This transmission should be transmitted either as RATDMA or FATDMA.

Required results

Confirm that that the EUT transmits the appropriate VDM message.

13.9 Transmission of DGNSS correction data (msg17)

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Input DGNSS data via

a) presentation interface as a VDM sentence or
b) RTCM port.

Required results

Confirm that DGNSS msg. 17 is transmitted in accordance with the configuration.

Confirm that the DGNSS data content is correct.

14 Physical Radio Tests

14.1 TDMA Transmitter

14.1.1 (M1371/A2-2.4.3) Frequency Error

Definition

The frequency error of the transmitter is the difference between the measured carrier frequency in the absence of modulation of the transmitter and its required frequency.

Method of measurement

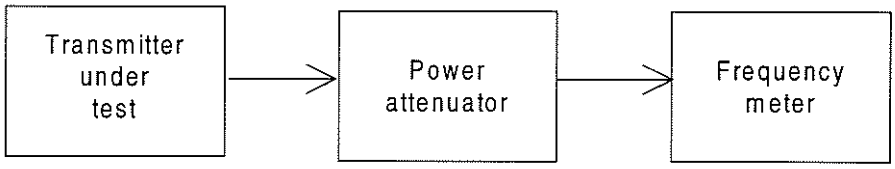


Figure 5 Measurement arrangement

The equipment shall be connected as illustrated.

The carrier frequency shall be measured in the absence of modulation. The measurement shall be made under normal test conditions and extreme test conditions.

Tests shall be performed on 4 channels (156.025 MHz, 157.4125 MHz, 160.6375 MHz, 162.025 MHz).

Required results

The frequency error shall not exceed ±0.5 kHz, under normal and ±1 kHz under extreme test conditions.

14.1.2 (M1371/A2-2.13.2) Carrier Power

Definition

The transmitter carrier power (conducted) is the mean power delivered to a nominal 50 Ohm load during a radio frequency cycle. The rated output power is the carrier power (conducted) defined as nominal High and Low.

Note: The equipment is designed to operate with different carrier powers. This measurement shall be performed at the nominal low and nominal high power setting.

Method of measurement

The measurement shall be carried out under normal and extreme test conditions on both high and low power settings.

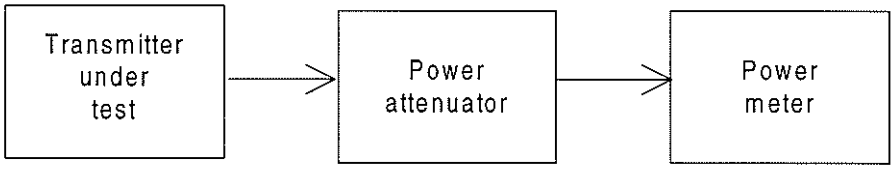


Figure 6 Measurement arrangement

Required results

The carrier power (conducted) shall be within ± 1,5 dB of the rated carrier power (conducted).

The carrier power (conducted) under extreme test conditions shall be within + 2,0 dB and - 3,0 dB of the rated output power.

14.1.3 (M1371/A2-2.4.2) Modulation Spectrum 25 kHz channel mode

Method of measurement

This test is produced to insure that the modulation sidebands produced by the specified test patterns, fall within the allowable masks.

Two methods of measurements are accepted.

a) The test shall be performed using the modulation and transmitter keying of the EUT.

b) Alternatively, to perform this test the manufacturer shall provide access to the modulator and the transmitter key. An external test signal shall be applied to the EUT.

The test shall be carried out using standard modulation, for both DSC and TDMA modes, using successively standard test signals 1, 2 and 3. See 12.2.4.

Using standard modulation, for both DSC and TDMA modes, the emission mask for 25kHz channel mode is:

At ±10kHz removed from the carrier, the modulation sidebands is below - 25dBc.

At ±25kHz removed from the carrier, the modulation sidebands is below - 70dBc, without any need to be below 0.25μW.

In the region between ±10kHz and ±25kHz removed from the carrier, the modulation sidebands is below a line specified between these two points.

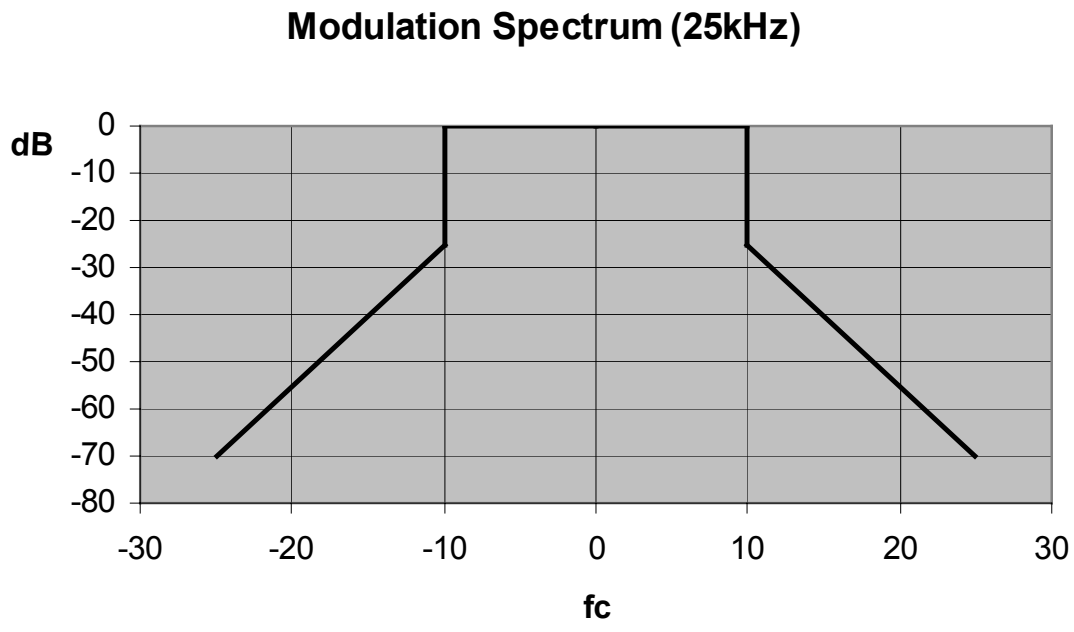


Figure 7: Modulation spectrum 25kHz

Required result

The modulation spectrum shall be within the mask specified in figure 7.

14.1.4 (M1371/A2-2.4.2) Modulation Spectrum 12.5 kHz channel mode

Method of measurement

This test is produced to insure that the modulation sidebands produced by the specified test patterns, fall within the allowable masks.

Two methods of measurements are accepted.

a) The test shall be performed using the modulation and transmitter keying of the EUT.
b) Alternatively, to perform this test the manufacturer shall provide access to the modulator and the transmitter key. An external test signal shall be applied to the EUT.

The test shall be carried out using standard modulation in TDMA mode, using successively standard test signals 2 and 3. See 12.2.4.

The emission mask for 12.5 kHz channel mode is:

At ±12.5 kHz removed from the carrier, the modulation sidebands is below –60 dBc

In the region between ±2.5 kHz and ±12.5 kHz removed from the carrier, the modulation sidebands is below a line starting at 0 dBc / ±2.5 dBc and ending at –60 dBc / ±12.5 kHz without any need to be below 0.25 μW.

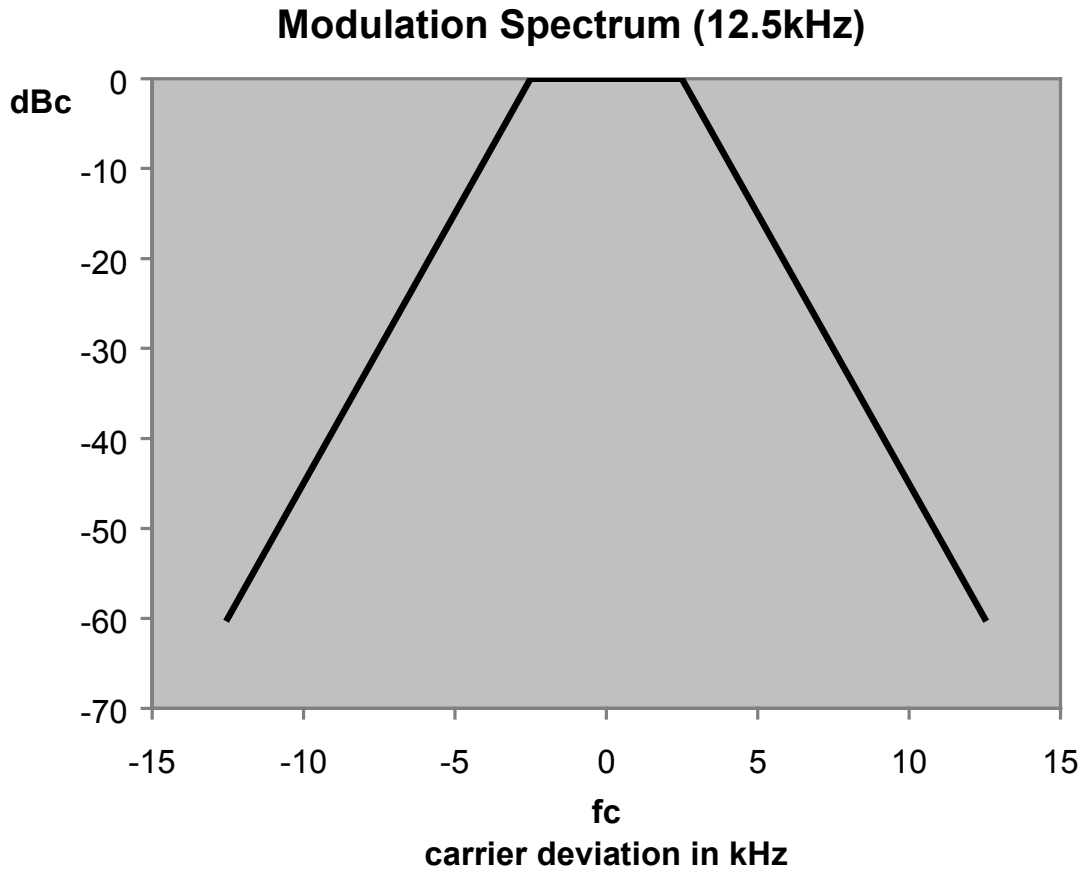


Figure 8: Modulation spectrum 12.5 kHz

Required result

The modulation spectrum shall be within the mask specified in figure 8.

14.1.5 (M1371/A2-2.12.1) Transmitter Attack Time

Definition

The transmitter attack time (t_a) is the time which elapses between the initiation of the "transmitter on" function (T_o, see figure 3.2.2.10 in Rec. ITU-R M.1371-1) and:

a) The moment when the transmitter output power has reached a level 1 dB below or 1,5 dB above the steady state power (P_c) and maintains a level within +1,5 dB / -1 dB from P_c thereafter as seen on the measuring equipment or in the plot of power as a function of time; or

b) The moment after which the frequency of the carrier always remains within ±1 kHz of its steady state frequency, F_c , as seen on the measuring equipment or the plot of frequency as a function of time, whichever occurs later.

The choice of conditions for b), is made in order to make the method of measurement easier to perform and to have good repeatability. Under these conditions, the frequency of the carrier shall be within the required frequency tolerance a few ms after the end of the attack time as defined in b).

Method of measurement

The measurement is carried out with an unmodulated carrier.

The measurement procedure shall be as follows:

a) The transmitter is connected to a RF detector and to a test discriminator via a matched test load. The attenuation of the test load shall be chosen in such a way that the input of the test discriminator is protected against overload and the limiter amplifier of the test discriminator operates correctly in the limiting range as soon as the transmitter carrier power (before attenuation) exceeds 1 mW. A dual trace storage oscilloscope (or a transient recorder) records the amplitude transient from the detector on a logarithmic scale and the frequency transient from the discriminator;A trigger device may be required to ensure that the start of the sweep of the oscilloscope time base occurs at the instant at which the "transmitter on" function is initiated. The measuring arrangement is shown in figure 9.

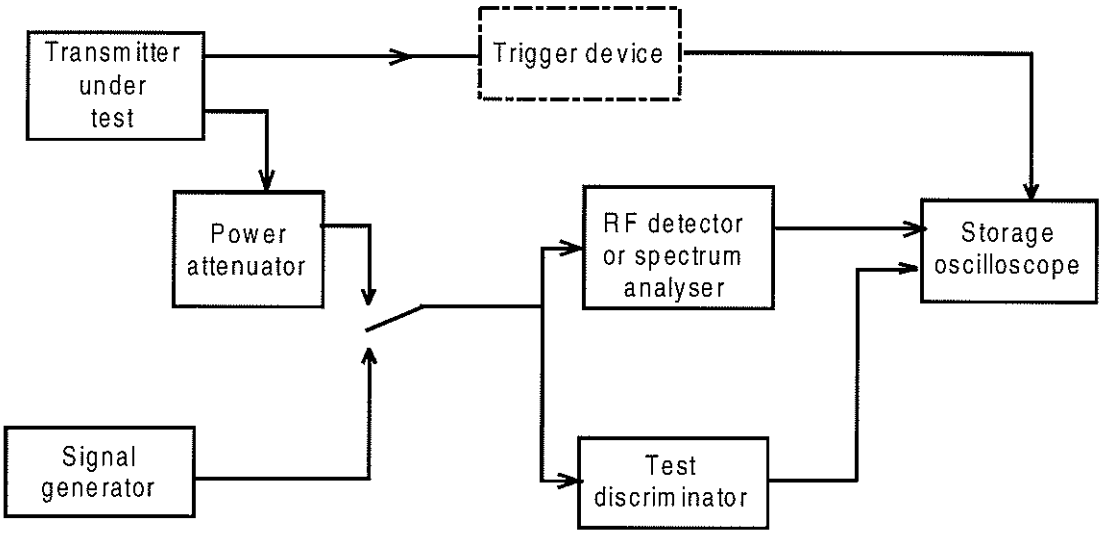


Figure 9 Test arrangement for transient behaviour of transmitter power and frequency, including transmitter attack and release time

The test discriminator may consist of a mixer and a local oscillator (providing the auxiliary frequency) used to convert the transmitter frequency to be measured into the frequency fed to the (broadband) limiter amplifier and the associated broadband discriminator:

- the test discriminator shall be sensitive enough to measure input signals down to Pc - 30 dB;
- the test discriminator shall be fast enough to display the frequency deviations (approximately 100 kHz/100 ms);
- the test discriminator output shall be dc coupled.

A spectrum analyser and a test discriminator/storage oscilloscope can also be used.

b) The traces of the oscilloscope shall be calibrated in power and frequency (y-axis) and in time (x-axis), using the signal generator;

c) The transmitter attack time may (preferably) be measured by direct reading on the oscilloscope while the transmitter is unmodulated.

Required result

The transmitter attack time shall not exceed 1 ms, and the transient power level shall not exceed +1.5 dB of its final value at any time. The carrier frequency shall not exceed +/- 1 kHz of its required value after 1 ms.

14.1.6 (M1371/A2-2.12.3) Transmitter Release Time

Definition

The transmitter release time (t_r) is the time which elapses between the initiation of the "transmitter off" function and the moment when the transmitter output power has reduced to a level 50 dB below the steady state power (P_c) and remains below this level thereafter as seen on the measuring equipment or in the plot of power as a function of time.

Method of measurement

For the test arrangement, see paragraph **Error! Reference source not found.** Figure 20.4.

The measurement is carried out with an unmodulated carrier.

The measurement procedure shall be as follows:

a) The transmitter is connected to a RF detector and to a test discriminator via a matched power attenuator. Its attenuation shall be chosen in such a way that the input of the test discriminator is protected against overload and that the limiter amplifier of the test discriminator operates correctly in the limiting range as long as the transmitter carrier power (before attenuation) exceeds 1 mW. A dual trace storage oscilloscope (or a transient recorder) records the amplitude transient from the detector on a logarithmic scale and the frequency transient from the discriminator. A trigger device may be required to ensure that the start of the sweep of the oscilloscope timebase occurs the instant at which the "transmitter off" function is initiated. If the transmitter possesses an automatic powering down facility (e.g. in the case of fixed length message transmission), it may replace the trigger device for starting the sweep of the oscilloscope. A spectrum analyser and a test discriminator/storage oscilloscope may also be used.
b) The traces of the oscilloscope shall be calibrated in power and frequency (y-axis) and in time (x-axis) by replacing the transmitter and test load by the signal generator;
c) The transmitter release time shall be measured by direct reading on the oscilloscope while the transmitter is preferably unmodulated.

Required result

The transmitter release time shall not exceed 1 ms.

14.1.7 Shutdown Procedure for an AIS base station

The required value for the initiation of the shutdown procedure (refer to Recommendation ITU-R M.1371-1, A2, §2.14 together with appropriate IALA Technical Clarification) of the AIS base station is dependent on whether or not the AIS base station is equipped with the optional DSC functionality:

- AIS base station *without* DSC functionality: The AIS base station should shut down the TDMA transmitter after one (1) second.
- AIS base station *with* optional DSC functionality: The AIS base station should shut down the transmitter after 1.1 seconds.

  Rationale: The maximum symbol DSC base station transmission is nominal 1 second (refer to Annex D for calculation).

14.2 (ITU-R M.825-3) DSC Transmissions

14.2.1 Frequency error of the DSC Signal

Definition

The frequency error for the B (2100Hz) and Y (1300Hz) state is the difference between the measured frequency from the demodulator and the nominal values.

Method of measurement

The transmitter shall be connected to the artificial antenna as specified in 12.2.11 and a suitable FM demodulator. The transmitter shall be set to channel 70.

The equipment shall be set to transmit a continuous B or Y state.

The measurement shall be performed by measuring the modulated output, for both the continuous B and Y state.

The measurements shall be carried out under normal and extreme test conditions.

Required results

The B and Y state frequencies for both normal and extreme test conditions shall be within +/- 1%.

14.2.2 Modulation Rate

Definition

The modulation rate is defined as the bit stream speed measured in bit/s.

Method of Measurement

The equipment shall be set to transmit continuous dot pattern. The RF output terminal of the equipment shall be connected to a linear FM demodulator followed by a suitable FSK demodulator.

Required results

The baud rate shall be 1200 bits/sec ± 30 ppm.

14.3 TDMA Receivers

14.3.1 Sensitivity – 25kHz Operation

Definition

The maximum usable sensitivity (data or messages, conducted) is the minimum level of signal (dBm) at the receiver input, produced by a carrier at the nominal frequency of the receiver, modulated with the normal test signal, which will, without interference, produce after demodulation a data signal with a specified packet error rate (PER).

Method of Measurement

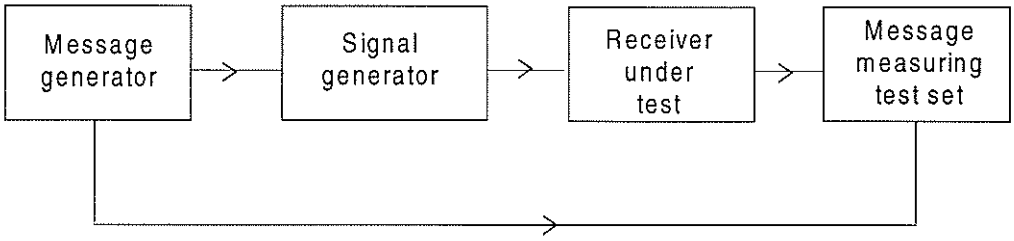


Figure 10 Measurement arrangement

Table 21

Parameter	Bits
Preamble	24
Start flag	8
Data	168
CRC	16

Parameter	Bits
End flag	8
Total	224

Two (2) types of packets shall be used: one which has a data field with a bit pattern consisting of alternating ones and zeroes (101010101…), one, which has a bit pattern with alternating double ones and double zeroes (110011001100…). The test shall alternate between the two types during the test process.

Note: It is allowed to use a broadcast binary message structure for this test. In this case, the data field is reduced by 40 bits, which will be occupied by the message id for broadcast binary message and the unique identifier for the transmitting station (MMSI). The application identifier shall be selected so that it corresponds with the selected bit pattern.

A minimum of 1000 packets shall be transmitted during the test. The PER shall be derived by dividing the received packets with the number of transmitted packets. The test shall be performed with the frequencies 156.025 MHz and 162.025 MHz.

Required results

The sensitivity shall be –107 dBm under normal test conditions, and –101 dBm under extreme test conditions, when operating on a 25 kHz channel with a PER of 20% (This corresponds to a BER of $10^{-3)}$.

14.3.2 Sensitivity – 12.5kHz Operation

Definition

The maximum usable sensitivity (data or messages, conducted) is the minimum level of signal (dBm) at the receiver input, produced by a carrier at the nominal frequency of the receiver, modulated with the normal test signal, which will, without interference, produce after demodulation a data signal with a specified packet error rate (PER).

Method of measurement

Use the method of 14.3.1. The test shall be performed with the frequencies 157.4125 MHz and 160.6375 MHz.

Required result

The sensitivity shall be –104 dBm under normal test conditions, and –98 dBm under extreme test conditions, when operating on a 12.5 kHz channel with a PER of 20% (This corresponds to a BER of $10^{-3)}$.

14.3.3 Error Behaviour at High Input Levels

Definition

The error behaviour (performance) at high input levels (noise free operation) is defined in the same manner as for the measurement of the maximum usable sensitivity when the level of the wanted signal is significantly above the maximum wanted sensitivity.

Method of measurement

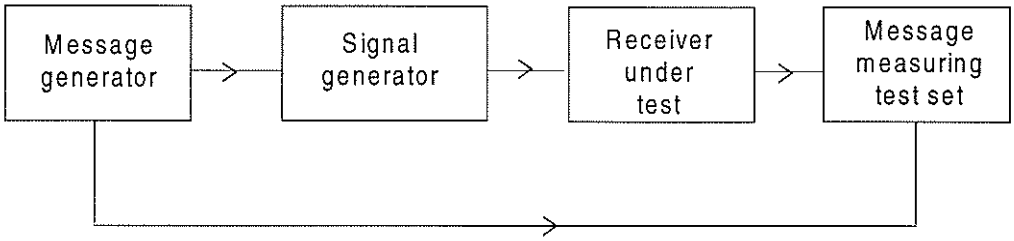


Figure 11 Measurement arrangement

The measurement procedure shall be as follows:

a) an input signal with a frequency equal to the nominal frequency of the receiver, having normal test modulation (see 12.2.4.2 and 12.2.4.3), in accordance with the instructions of the manufacturer and agreed by the testing laboratory, shall be applied to the receiver input terminals;

b) the level of the input signal shall be adjusted to a level which is –77 dBm for the degradation measurements;

c) the normal test signal shall then be transmitted 100 times whilst observing in each case whether or not a message is successfully received;

d) the number of messages not successfully received shall be recorded;

e) the measurement shall be repeated with the input signal of the receiver at a level of –7 dBm for the degradation measurements.

Required results

The number of messages not correctly received (lost or corrupted) shall not exceed 1 at -7dBm.

14.3.4 Co-Channel Rejection – 25kHz Operation

Definition

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

Method of measurement

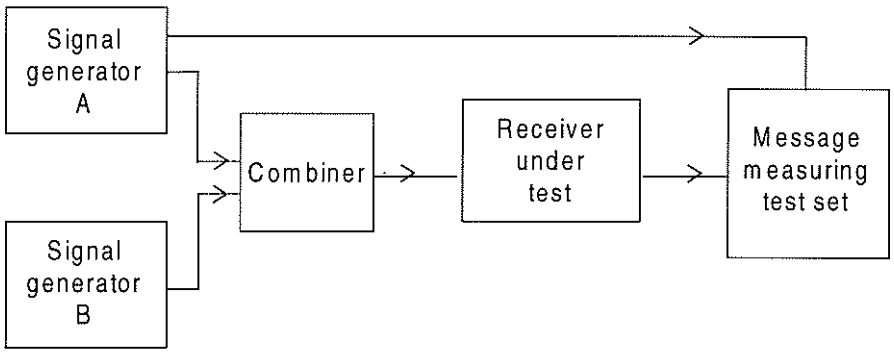


Figure 12 Measurement arrangement

The measurement procedure shall be as follows:

a) Two signal generators, A and B, shall be connected to the receiver via a combining network.

   The wanted signal, provided by signal generator A, shall be at the nominal frequency of the receiver and shall have normal test modulation (see 12.2.4).

   The unwanted signal, provided by signal generator B, shall be modulated with a 400 Hz signal with a deviation of 12 % of the channel separation. Both input signals shall be at the nominal frequency of the receiver.

b) Initially, signal generator B (unwanted signal) shall be switched off (maintaining the output impedance).

   The level of the wanted signal from generator A shall be adjusted to a level which is 6 dB above the level of the limit of the maximum usable sensitivity as specified in 14.3.1 at the receiver input terminals (i.e. 6 dB above –107 dBm under normal test conditions).

c) Signal generator B shall then be switched on, and the level of the unwanted signal adjusted until a successful message ratio of less than 10 % is obtained.

d) The normal test signal (see 12.2.4) shall then be transmitted repeatedly while observing in each case whether or not a message is successfully received.

   The level of the unwanted signal shall be reduced by 2 dB for each occasion that a message is not successfully received.

   The procedure shall be continued until three consecutive messages are successfully received. The level of the input signal shall then be noted.

e) The level of the unwanted signal shall be increased by 1 dB and the new value noted.

   The normal test signal (see 12.2.4) shall then be transmitted 20 times. In each case, if a message is not successfully received the level of the unwanted signal shall be reduced by 1 dB and the new value noted.

   If a message is successfully received, the level of the unwanted signal shall not be changed until three consecutive messages have been successfully received. In this case the unwanted signal shall be increased by 1 dB and the new value noted.

   No level of the unwanted signal level shall be noted unless preceded by a change in level.

   The average of the values noted in steps b) and c) (which provides the level corresponding to the successful message ratio of 80 %) shall be noted.

f) For each frequency of the unwanted signal, the co-channel rejection ratio shall be expressed as the ratio, in dB, of the average level noted in step c) to the level of the wanted signal, at the receiver input. This ratio shall be recorded.

g) The measurement shall be repeated for displacements of the unwanted signal of ±12 % of the channel separation.

h) The co-channel rejection of the equipment under test shall be expressed as the lowest of the three values expressed in dB, calculated in step d).

   The value of the co-channel rejection ratio, expressed in dB, is generally negative (therefore, for example, - 12 dB is lower than - 8 dB).

i) Repeat this test using test signal 2 (as defined in 12.2.4.2) in place of signal generator B. Repeat test i) using test signal 2 adjusted to a level of –7dBm.

Required result

The value of the co-channel rejection ratio, expressed in dB, at the signal displacements given in the method of measurement, shall be between -10,0 dB and 0 dB. Any positive value is also acceptable.

14.3.5 Co-Channel Rejection – 12.5kHz Operation

Definition

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

Method of measurement

Use the method of 14.3.4.

Required result

The value of the co-channel rejection ratio, expressed in dB, at the signal displacements given in the method of measurement, shall be between - 18,0 dB and 0 dB. Any positive value is also acceptable.

14.3.6 Adjacent Channel selectivity - 25kHz Operation

Definition

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted signal which differs in frequency from the wanted signal by an amount equal to the adjacent channel separation for which the equipment is intended.

Method of measurement

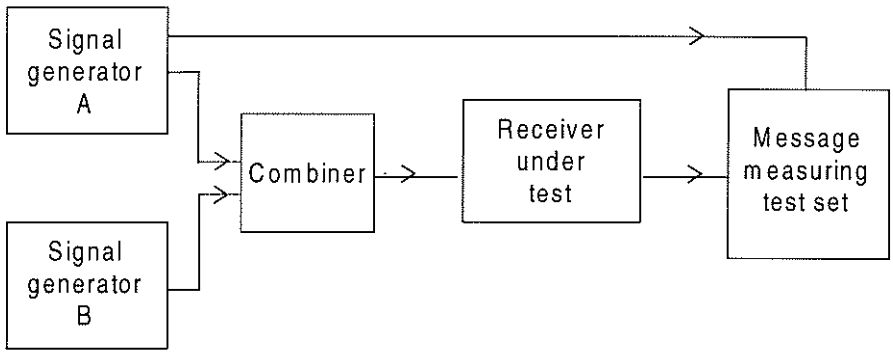


Figure 13 Measurement arrangement with messages

The measurement procedure shall be as follows:

a) Two signal generators, A and B, shall be connected to the receiver via a combining network.

   The wanted signal, provided by signal generator A, shall be at the nominal frequency of the receiver and shall be modulated by the normal test signal (see 12.2.4).

   The unwanted signal, provided by signal generator B, shall be an unmodulated signal and shall be at the frequency of the channel immediately above that of the wanted signal.

b) Initially, signal generator B (unwanted signal) shall be switched off (maintaining the output impedance).

   The level of the wanted signal from generator A shall be adjusted to the level which is 3 dB above the level of the limit of the maximum usable sensitivity as specified in subclause 14.3.1, at the receiver input terminals (i.e. 6 dB above –113 dBm under normal test conditions).

c) Signal generator B shall then be switched on, and the level of the unwanted signal adjusted until a successful message ratio of 10 % is obtained.

d) The normal test signal 18.2.4 shall be transmitted repeatedly whilst observing in each case whether or not a message is successfully received.

e) The level of the unwanted signal shall be reduced in steps of 2 dB for each occasion that a message is not successfully received.

The procedure shall be continued until three consecutive messages are successfully received. The level of the input signal shall then be noted.

f) The level of the unwanted signal shall be increased by 1 dB and the new value noted.

The normal test signal (see 12.2.4) shall then be transmitted 20 times. In each case, if a message is not successfully received the level of the unwanted signal shall be reduced by 1 dB and the new value noted.

If a message is successfully received, the level of the unwanted signal shall not be changed until three consecutive messages have been successfully received. In this case the unwanted signal shall be increased by 1 dB and the new value noted.

No level of the unwanted signal shall be noted unless preceded by a change in level.

g) The average of the values noted in steps d) and e) (which provides the level corresponding to the successful message ratio of 80 %) shall be noted.

h) For each adjacent channel, the selectivity shall be expressed as the ratio, in dB, of the level of the unwanted signal to the level of the wanted signal, at the receiver input. This ratio shall be recorded.

i) The measurement shall be repeated with the unwanted signal at the frequency of the channel below that of the wanted signal.

j) The adjacent channel selectivity of the equipment under test shall be expressed as the lower of the two values measured in the upper and lower channels nearest to the receiving channel (see step f above).

k) the measurement shall be repeated under extreme test conditions (extreme temperature and extreme voltages applied simultaneously), using the level of the wanted signal, as specified in 14.3.1, increased by 6 dB.

Required results

The adjacent channel selectivity shall be no less than the values given in table 22.

Table 22: Adjacent channel selectivity 25kHz

Channel separation	25 kHz
Normal test conditions	70,0 dB
Extreme test conditions	60,0 dB

14.3.7 Adjacent Channel selectivity - 12.5kHz Operation

Definition

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted signal which differs in frequency from the wanted signal by an amount equal to the adjacent channel separation for which the equipment is intended.

Method of measurement

Use the method in 20.3.6

Required results

The adjacent channel selectivity shall be no less than the values given in table 23.

Table 23: Adjacent channel selectivity 12,5kHz

Channel separation	12,5 kHz
Normal test conditions	50,0 dB
Extreme test conditions	50,0 dB

14.3.8 Spurious Response Rejection

Definition

The spurious response rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal at any other frequency, at which a response is obtained.

Method of measurement

To determine the frequencies at which spurious responses can occur the following calculations shall be made:

a) calculation of the "limited frequency range":

The limited frequency range is defined as the frequency of the local oscillator signal (f_{LO}) applied to the first mixer of the receiver plus or minus the sum of the intermediate frequencies (f_{I1} ,...f_{In}) and half the switching range (sr) of the receiver (156 – 163 MHz); hence, the frequency f_I of the limited frequency range is;

$$f_{LO} - \sum_{j=I}^{j=n} f_{Ij} - \frac{sr}{2} \leq f_I \leq f_{LO} + \sum_{j=I}^{j=n} f_{Ij} + \frac{sr}{2}$$

b) calculation of frequencies outside the limited frequency range:

A calculation of the frequencies at which spurious responses can occur outside the range determined in a) is made for the remainder of the frequency range of interest.

The frequencies outside the limited frequency range are equal to the harmonics of the frequency of the local oscillator signal (f_{LO}) applied to the first mixer of the receiver plus or minus the first intermediate frequency (f_{I1}) of the receiver; hence, the frequencies of these spurious responses are:

$$nf_{LO} \pm f_{I1}$$

where n is an integer greater than or equal to 2.

The measurement of the first image response of the receiver shall initially be made to verify the calculation of spurious response frequencies.

For the calculations a) and b) above, the manufacturer shall state the frequency of the receiver, the frequency of the local oscillator signal (f_{LO}) applied to the 1st mixer of the receiver, the intermediate frequencies (f_{I1} , f_{I2} etc.), and the switching range (sr) of the receiver.

Method of search over “limited frequency range”

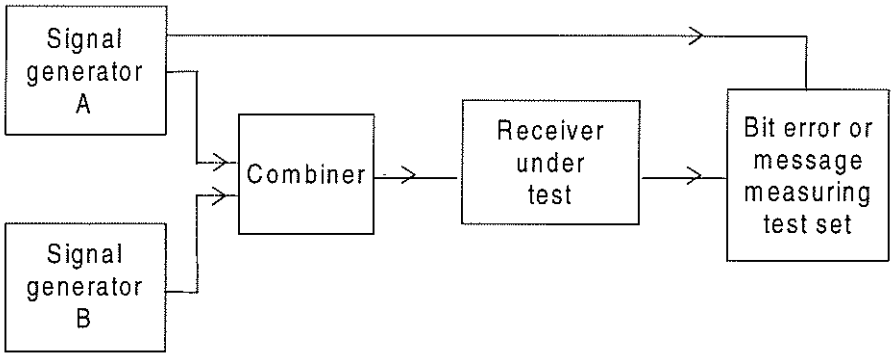


Figure 14: Measurement arrangement

The measurement procedure shall be as follows:

a) Two signal generators, A and B, shall be connected to the receiver via a combining network.

   The wanted signal, provided by signal generator A, shall be at the nominal frequency of the receiver and shall have the normal test signal or modulation (see 12.2.4).

   The unwanted signal, provided by signal generator B, shall be modulated with a 400 Hz signal with a deviation of 12 % of the channel separation.

b) Initially, signal generator B (unwanted signal) shall be switched off (maintaining the output impedance).

   The level of the wanted signal from generator A shall be adjusted to the level which is 3 dB above the level of the limit of the maximum usable sensitivity as specified in 14.3.1, at the receiver input terminals (i.e. 6 dB above –113 dBm under normal test conditions).

   In the case where a continuous bit stream is used, the bit error ratio of the receiver after demodulation shall be noted.

c) Signal generator B shall then be switched on, and the level of the unwanted signal adjusted to –27 dBm at the receiver input terminals.

   The frequency of the unwanted signal generator shall be varied in increments of 5 kHz over the limited frequency range and over the frequencies in accordance with the calculations outside of this frequency range.

d) The frequency of any spurious response detected (e.g. by an increase in the previously noted bit error ratio) during the search shall be recorded for use in the measurements in accordance with the measure.

e) In the case where operation using a continuous bit stream is not possible a similar method shall be used. In such case, instead of identifying a spurious response by noting an increase in the bit error ratio, spurious responses shall be identified by a degradation of the successful message ratio.

Method of measurement with messages

The measurement shall be performed as follows, using the measurement arrangement of figure 14:

a) Two signal generators, A and B, shall be connected to the receiver via a combining network.

   The wanted signal, provided by signal generator A, shall be at the nominal frequency of the receiver and shall have normal test modulation (see 12.2.4).

The unwanted signal, provided by signal generator B, shall be modulated with a frequency of 400 Hz and with a deviation of 12 % of the channel separation and shall be at the frequency of that spurious response being considered.

b) Initially, signal generator B (unwanted signal) shall be switched off (maintaining the output impedance).

The level of the wanted signal from generator A shall be adjusted to the level which is 3 dB above the level of the limit of the maximum usable sensitivity as specified in subclause 14.3.1, at the receiver input terminals (i.e. 6 dB above –113 dBm under normal test conditions).

c) Signal generator B shall then be switched on, and the level of the unwanted signal adjusted until a successful message ratio of less than 10 % is obtained.

d) The normal test signal (subclause 10.4) shall then be transmitted repeatedly whilst observing in each case whether or not a message is successfully received.

The level of the unwanted signal shall be reduced by 2 dB for each occasion that a message is not successfully received.

The procedure shall be continued until three consecutive messages are successfully received. The level of the input signal shall then be noted.

e) The level of the unwanted signal shall be increased by 1 dB and the new value noted.

The normal test signal (see 12.2.4) shall then be transmitted 20 times. In each case, if a message is not successfully received the level of the unwanted signal shall be reduced by 1 dB and the new value noted.

If a message is successfully received, the level of the unwanted signal shall not be changed until three consecutive messages have been successfully received. In this case the unwanted signal shall be increased by 1 dB and the new value noted.

No level of the unwanted signal shall be noted unless preceded by a change in level.

The average of the values noted in steps d) and e) (which provides the level corresponding to the successful message ratio of 80 % shall be noted.

f) For each frequency, the spurious response rejection shall be expressed as the ratio, in dB, of the level of the unwanted signal to the level of the wanted signal, at the receiver input. This ratio shall be recorded.

g) The measurement shall be repeated at all spurious response frequencies found during the search over the limited frequency range, and at frequencies calculated for the remainder of the spurious response frequencies in the frequency range from f_{Rx} / 3,2 or 30 MHz, whichever is higher, to $3{,}2 \times f_{Rx}$, where f_{Rx} is the nominal frequency of the receiver.

h) The spurious response rejection of the equipment under test shall be expressed as the lowest value recorded in step f).

Required results

At any frequency separated from the nominal frequency of the receiver by two channels or more, the spurious response rejection shall not be less than 70,0 dB.

14.3.9 Intermodulation response rejection and Blocking

Definition

The intermodulation response rejection is the capability of the receiver to receive a wanted modulated signal, without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.

Method of test

Four signal generators shall be connected to the AIS transponder under test (see figure 15). The wanted signals, represented by signal generator A, shall be set up in accordance with the packet error rate measurement (see paragraph 14.3.3) to the TDMA AIS test in accordance with table 5. The wanted signal levels at the RF input of the AIS transponder shall be set to -101 dBm.

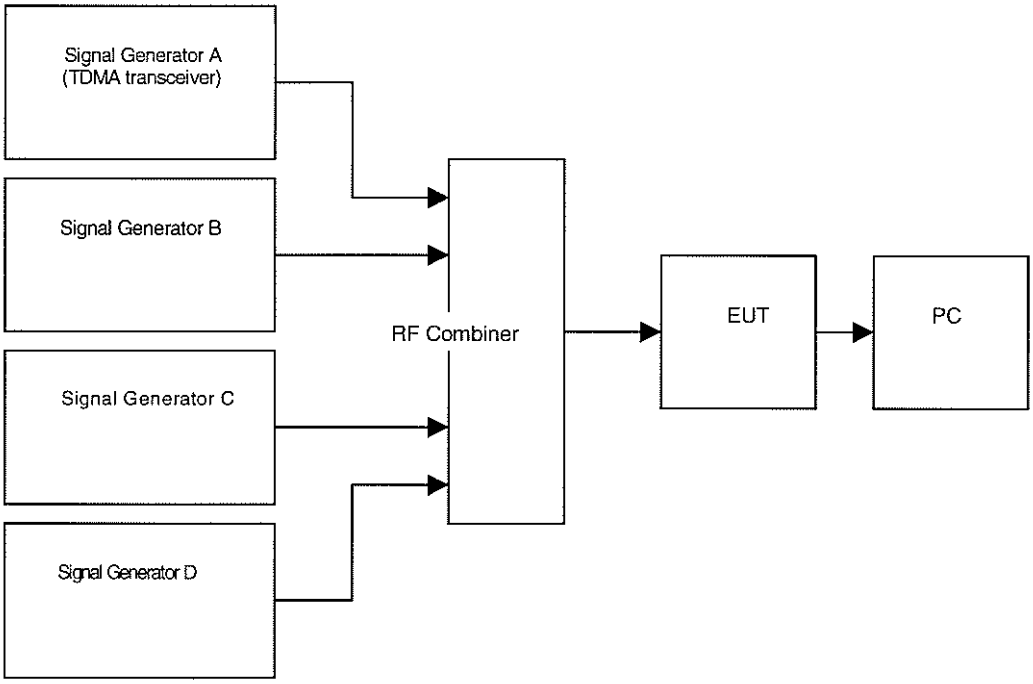


Figure 15: Test set-up

The unwanted signal from signal generator B shall be modulated by 400Hz with a deviation of +/-3 kHz and adjusted to a frequency 500 kHz above or below the frequency of the AIS1 channel. The unwanted signal from signal generator C shall be unmodulated and adjusted to a frequency 1000 kHz above or below the frequency of the AIS channel. The unwanted signal levels from signal generators B and C at the RF input of the AIS transponder shall be set to –27 dBm.

The unwanted signal from signal generator D shall be unmodulated and adjusted to a frequency 5.725 MHz above or below the frequency of the AIS channel. The unwanted signal level from signal generator D at the RF input of the AIS transponder shall be set to –15 dBm.

Table 24

	Generator A	**Generator B**	**Generator C**	**Generator D**
Test #1	156.025	156.525	157.025	161.750
Test #2	162. 025	161.525	161.025	156.300

Required results

The packet error rate, with the outputs of signal generators B, C, and D switched on, shall be 20% or less.

14.3.10 (ITU-R M.1371 A2/2.12.4) Transmit to receive switching time

Definition

The transmit to receive switching time describes the capability of the TDMA receiver to receive in the slot immediately following the transmission slot.

Method of measurement

Configure the measurement in accordance with figure 14, but add a 30 dB power attenuator between the receiver under test and the signal generator from the TDMA transmitter in the unit under test. Set the TDMA transmitter in the unit under test to transmit at the default power setting (nominal 12.5 Watts) in the slot immediately preceding the slot used for performing the receiver sensitivity measurement specified in 14.3.1.

Required results

The sensitivity shall be –107 dBm with a PER of at most 20% under normal test conditions.

14.4 (ITU-R M.1371 A3) DSC Receiver

14.4.1 Maximum Sensitivity

Definition

The maximum sensitivity of the receiver is the minimum level of the signal dBm at the nominal frequency of the receiver which when applied to the receiver input with a test modulation will produce a bit error rate of 10^{-2}.

Method of measurement

The test equipment shall be set to transmit continuous DSC dot pattern as the test modulation of the RF signal generator connected to the EUT. The EUT shall provide a logic level test output from its internal DSC demodulator to measure bit error rate.

Required result

The maximum usable sensitivity shall not exceed –107 dBm under normal test conditions, and –101 dBm under extreme test conditions. The test shall be repeated at the nominal carrier frequency (156,525 MHz) +/- 1,5 kHz.

14.4.2 (ITU-R M.1371 A3) Error Behaviour at High Input Levels

Definition

The dynamic range of the equipment is the range from the minimum to the maximum level of a radio frequency input signal at which the bit error rate in the output of the receiver does not exceed a specified value.

Method of measurement

A test signal, in accordance with standard test signal number 1, shall be applied to the receiver input. The level of the test signal shall be –7dBm.

Required result

The BER shall not exceed 10^{-2}.

14.4.3 (ITU-R M.1371 A3) Co-Channel Rejection

Definition

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at nominal frequency of the receiver.

Method of measurement

The wanted signal shall be standard test signal number 2. The level of the wanted signal shall be -104 dBm.

The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz. The input level of the unwanted signal shall be –112 dBm.

Both input signals shall be at the nominal frequency of the receiver under test and the measurement shall be repeated for displacements of the unwanted signal of up to ±3 kHz.

Required result

The value of the co-channel rejection ratio, expressed in dB, at the signal displacements given in the method of measurement, shall be between - 10,0 dB and 0 dB.

14.4.4 (ITU-R M.1371 A3) Adjacent Channel selectivity

Definition

The adjacent channel selectivity characterises the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal that differs in frequency from the wanted signal by 25 kHz.

Method of measurement

The wanted signal shall be standard test signal number 1. The level of the wanted signal shall be -104 dBm.

The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz. The input level of the unwanted signal shall be –34 dBm. The unwanted signal shall be tuned to the centre frequency of the upper adjacent channels.

The measurement shall be repeated with the unwanted signal tuned to the centre frequency of the lower adjacent channel.

Required result

The adjacent channel selectivity for different channel separations shall not be less than the values given in table 25.

Table 25: Adjacent channel selectivity DSC

Normal test conditions	70,0 dB
Extreme test conditions	60,0 dB

14.4.5 (ITU-R M.1371 A3) Spurious Response Rejection

Definition

The spurious response characterises the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal with frequencies outside the band of the receiver.

Method of measurement

The wanted signal shall be standard test signal number 1. The level of the wanted signal shall be -104 dBm.

The unwanted signal shall be unmodulated. The frequency shall be varied between 100 kHz and 2 GHz. The level of the unwanted signal shall be –24 dBm.

Required result

At any frequency separated from the nominal frequency of the receiver by two channels or more, the spurious response rejection shall not be less than 70,0 dB.

14.4.6 (ITU-R M.1371 A3) Intermodulation response Rejection

Definition

The inter-modulation response ratio characterises the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.

Method of measurement

The wanted signal represented by signal generator A shall be at the nominal frequency of the receiver and shall be standard test signal number 1. The level of the wanted signal shall be –104 dBm.

The unwanted signal from signal generator B shall be unmodulated and adjusted to a frequency 50 kHz above the nominal frequency of the receiver. The second unwanted signal from signal generator C shall be modulated by 400 Hz with a deviation of ±3 kHz and adjusted to a frequency 100 kHz above the nominal frequency of the receiver. The input level of each unwanted signal shall be –39 dBm. The test shall be repeated with the frequency of the unwanted signals below the nominal frequency of the receiver.

Required result

The intermodulation response rejection ratio shall not be less 65,0 dB.

14.4.7 (ITU-R M.1371 A3) Blocking or Desensitisation

Definition

The blocking immunity characterises the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal with frequencies outside the band of the receiver.

Method of measurement

The wanted signal shall be standard test signal number 2. The level of the wanted signal shall be -104 dBm.

The unwanted signal shall be unmodulated. The frequency shall be varied between –10 MHz and -1 MHz and also between +1 MHz and +10 MHz relative to the nominal frequency of the wanted signal. The level of the unwanted signal shall be –20 dBm.

Required result

The blocking ratio for any frequency within the specified ranges shall not be less than 84,0 dB, except at frequencies on which spurious responses are found.

14.5 Conducted Spurious Emissions conveyed to the antenna

14.5.1 (ITU-R M.489-2) Spurious Emissions from the Receiver

Definition

Conducted spurious emissions to the antenna are any RF emissions generated in the receiver and conveyed to the antenna terminal.

Method of Measurement

Conducted spurious emissions shall be measured as the power level of any frequency component to the antenna terminals of the receiver. The receiver antenna terminals are conducted to a spectrum analyser or selective voltmeter having an input impedance of 50 ohms and the receiver is switched on.

If the detecting device is not calibrated in terms of power input, the level of any detected components shall be determined by a substitution method using a signal generator. The measurement shall extend over the frequency range 150 kHz to 2 GHz.

Results Required

The power of any spurious emission in the specified range at the antenna terminal shall not exceed –57 dBm (2 nW) in the frequency range 150 kHz to 1 GHz and –37 dBm (20 nW) in the frequency range 1 GHz to 2 GHz.

14.5.2 (ITU-R M.489-2) Spurious Emissions From the Transmitter

Definition

Conducted spurious emissions are emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic missions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Method of Measurement

Conducted spurious emissions shall be measured with the unmodulated transmitter connected to the artificial antenna. The measurement shall be made over a frequency range from 150 kHz to 2 GHz, excluding the channel on which the transmitter is operating and its adjacent channels.

Results Required

The power of any spurious emission on any discrete frequency shall not exceed 0,25 uW in the frequency range 150 kHz to 1 GHz and 1 uW in the frequency range 1 GHz to 2 GHz

15 Specific tests of Link Layer

15.1 (M.1371 A1/3.1.1) TDMA Synchronisation

15.1.1 (M.1371 A1/3.1.3.4.1) Synchronisation test using UTC

Method of measurement

Set up standard test environment; chose test conditions in a way that the EUT operates in following synchronisation modes:

- UTC direct
- UTC indirect (internal GNSS receiver disabled; at least one other station UTC direct synchronised)
- BASE direct (internal GNSS disabled; base station with UTC direct synchronisation within range)

Check CommState Parameter SyncState in position Report and reporting rate

Required result

Transmitted Communication state shall fit the Synchronisation mode

15.1.2 (M.1371 A1/3.1.1.4) Synchronisation test without UTC, semaphore

Method of measurement

Set up standard test environment without UTC available. Let EUT operate as a sync source (semaphore) for other stations. Check CommState Parameter SyncState in position Report and reporting rate.

Required results

Transmitted CommState shall fit the Synchronisation mode.

The EUT shall increase reporting rate to 3 1/3 s when acting as a semaphore.

15.1.3 (M.1371 A1/3.1.1) Synchronisation test without UTC

Method of measurement

Set up standard test environment; chose test conditions in a way that EUT operates in following sync modes:

a) BASE indirect (internal GNSS disabled; no station with UTC direct synchronisation or Base station within range,)
b) mobile direct (internal GNSS disabled; no station with UTC direct synchronisation or Base station within range,)
c) Enable internal GNSS in synchronisation modes other than UTC direct

Check CommState Parameter SyncState in position Report and reporting rate.

Required results

a,b) Transmitted Communication state shall fit the Synchronisation mode

c) Synchronisation mode shall revert to UTC direct

15.2 (M.1371 A1/3.1.2) Time division (Frame format)

Method of measurement

Operate EUT in normal mode. Transmit msg. 4 at standard interval (10 sec.)

Record VDL messages and check for used slots. Check parameter slot number in CommState of position report. Check slot length (transmission time)

Required results

Slot number used and slot number indicated in CommState shall match. Slot number shall not exceed 2249. Slot length shall not exceed 26,67msec.

15.3 (M.1371 A1/3.2.2.8.4) Synchronisation jitter

Definition

Synchronisation jitter (transmission timing error) is the time between nominal slot start as determined by the UTC synchronisation source and the initiation of the "transmitter on" function (T_o see figure 3.2.2.10 in Rec. ITU-R M.1371-1).

Method of measurement

Set-up standard test environment. Set the EUT to 25 kHz bandwidth, normal reporting rate of 10 (msg. 4) sec and using

a) UTC direct synchronisation

b) UTC indirect synchronisation by disconnecting the GNSS antenna of the EUT.

Record VDL messages and measure the time between the nominal beginning of the slot interval and the initiation of the "transmitter on" function. Alternative methods, e.g. by evaluating the start flag and calculating back to T_o are allowed.

Repeat the test for 12.5 kHz bandwidth.

Required results

The synchronisation jitter shall not exceed

a) ± 104 µs using UTC direct synchronisation

b) ± 312 µs using UTC indirect synchronisation .

15.4 Data encoding (bit stuffing)

Method of measurement

Setup standard test environment.

- apply a binary broadcast message (msg 8) to the VDL containing the HEX-values “7E 3B 3C 3E 7E” in the data portion and check Presentation Interface output of EUT
- apply a BBM message to the EUT initiating the transmission of msg 8 containing the HEX-values as above in the data portion and check the VDL

Required results

Confirm that data output on the presentation interface conforms to transmitted data

Transmitted VDL message conforms to data input on the Presentation Interface.

15.5 (M.1371 A1/3.2.3) Frame check sequence

Method of measurement

Apply a simulated position report message with wrong CRC bit sequence to the VDL.

Required results

Confirm that this message is not forwarded to the PI by the EUT.

15.6 (M.1371 A1/3.3) Slot allocation (Channel access protocols)

15.6.1 (M.1371 A1/3.3.4.3) scheduled transmissions (FATDMA)

Method of measurement

Set-up standard test environment.

Configure EUT by appling DLM sentence in order to reserve FATDMA slots (msg 20);

Apply CBM sentence specifying a start slot for msg 22 transmissions

Record transmitted scheduled reports msg 22 and check frame structure.

Required results

Check that msg. 22 transmissions are in accordance with configured schedule.

Repeat this test with different CBM sentence settings.

15.6.2 (M.1371 A1/3.3.2) Single message transmission (RATDMA)

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Apply a 1 slot Binary Broadcast message (msg 8) to the PI of the EUT. Record transmitted messages.

Required results

Confirm that EUT transmits this msg 8 within max. 4sec. Retry with 90% channel load.

15.6.3 (15.4, M.1371 A1/3.3.6) Assigned operation

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Apply an Assigned mode sentence (ASN) to the EUT with:

a) with preceding TBD2 sentence to specify slot access

b) without TBD2

Record transmitted messages.

Required results

Confirm that EUT

a) transmits msg 16 in slot defined by TBD2 using FATDMA

b) transmits msg 16 using RATDMA

Check that value for reporting rate is set to a multiple of 20.

15.7 (M.1371 A1/3.3.7) Message Formats

15.7.1 Received messages

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Apply messages according to table 13 in ITU-R M.1371-1 A2./16.3.4 to the VDL. Record messages output by the PI of EUT.

Required results

Confirm that EUT outputs corresponding message with correct field contents and format via the PI or responds as appropriate.

15.7.2 (M.1371 A1/3.3.7) Transmitted messages

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Initiate the transmission of messages relevant for a base station according to table 13 in ITU-R M.1371-1 A2./16.3.4 by the EUT.

Record transmitted messages 4,6,7,8,10,12,13,14,15,16,17,20,21,22.

Required results

Confirm that EUT transmits messages with correct field contents and format or responses as appropriate.

15.7.3 Retransmission of VDM messages

Method of measurement

Set-up standard test environment and operate EUT in normal mode.

Input VDM sentence for messages 1 to 22 via PI.

Check Comm state, delay, channel, message type, access mode, repeat indicator

Required results

Confirm that the appropriate messages are transmitted on the VDL.

16 Specific tests of Network Layer

16.1 (M.1371 A1/4.1) Dual channel operation

16.1.1 Alternate transmissions

Method of measurement

Set-up standard test environment and operate EUT in normal mode on default channels AIS1, AIS2. Record transmitted scheduled base station reports on both channels. Check CommState for slot allocation (msg. 4).

Required results

Confirm that EUT allocates slots in both channels alternating.

16.2 (M.1371 A1/4.1)) regional area designation by VDL message

Method of measurement

Set-up standard test environment and operate EUT in normal mode; transmit ACA sentence to PI of EUT. Record VDL transmissions.

Required results

Check that the EUT transmits msg 22 on channels A and/or B according to the configuration. Repeat test with different settings of CBM sentence.

16.3 Power setting

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Input CBM sentence via the PI with appropriate power level setting.

Required result

Check that EUT sets output power as defined.

16.4 (M.1371 A1/4.1.8) Message priority handling

Method of measurement

Set-up standard test environment and operate test equipment with 90% channel load. Record VDL messages and check for used slots. Initiate the transmission of two 5 slot messages (msg 12 and msg 8) by the EUT. Record transmitted messages on both channels.

Required results

Check that EUT transmits the messages in correct order according to their priority (ITU-R M.1371 A/3.3.8.1 table 13).

16.5 (M.1371 A1/4.4) Slot reuse (link congestion)

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Assure that at test receiver location the signal level received from EUT exceeds the signal level received from test transmitter. Record transmitted messages and check frame structure. Set up additional test targets to simulate a VDL load of >[90]% until slot reuse by EUT is observed. Transmit a 5 slot binary broadcast message 8 using RATDMA.

Required results

Confirm that the slot occupied by the most distant station (within selection interval) is used by the slot reuse algorithm. Check that a station is not subject to slot reuse more than once a frame. Check that slots allocated by a local base station are not subject to slot reuse.

17 Specific tests of Transport Layer

17.1 (M.1371 A1/5.3.1) Addressed messages

17.1.1 (M.1371 A1/5.3) Transmission

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Set up a test target for scheduled transmissions on channel AIS1 only. Initiate the transmission of an addressed binary message (msg 6) by the EUT (test target as destination). Record transmitted messages on both channels.

Required results

Check that the EUT transmits msg 6 on channel AIS1. Repeat test for AIS2.

17.1.2 Acknowledgement

Method of measurement

Operate standard test environment and EUT in normal mode. Apply up to 4 addressed binary messages (msg 6; EUT as destination) to the VDL on Channel AIS 1. Record transmitted messages on both channels. Repeat with AIS2.

Required results

Confirm that EUT transmits a binary acknowledge message (msg 7) with the appropriate sequence numbers within 4 sec on the channel where the msg 6 was received. Confirm that EUT transmit the result with an appropriate message to PI.

17.1.3 (M.1371 A1/5.3.1) Transmission Retry

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Initiate the transmission of up to 4 addressed binary messages by the EUT which will not be acknowledged (i.e. destination not available). Record transmitted messages.

Required results

Confirm that EUT retries the transmission up to 3 times (configurable) for each addressed binary message. Confirm that the time between transmissions is 4 to 8 sec. Confirm that EUT transmit the overall result with an appropriate message to PI.

17.1.4 Acknowledgement of Addressed safety related messages

Repeat test under 17.1.2 with addressed safety related message.

17.2 (M.1371 A1/5.3) Interrogation responses

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Apply an interrogation message (msg 15; EUT as destination) to the VDL according to message table 6.3.3.8.1 for responses with msg 4 and slot offset set to defined value on channel AIS 1. Record transmitted messages on both channels.

Required results

Check that EUT transmits the appropriate interrogation response message as requested on channel AIS1. Repeat test for AIS2.

17.3 (M.1371 A1/5.3) Other non periodic messages

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Initiate the transmission of 5 binary broadcast messages (msg 8) by the EUT, alternating on Channel A & B.. Record transmitted messages on both channels.

Required results

Check that EUT transmits the msg 8 messages on channels A and B.

18 Specific Presentation Interface Tests

18.1 General

The EUT (Equipment Under Test) including all necessary test equipment shall be set-up and checked that it is operational before testing commences.

The manufacturer shall provide sufficient technical documentation of the EUT and its interfaces in particular.

The following tests shall be carried out under "Normal" environmental conditions.

Where appropriate, tests against different clauses of this and other chapters may be carried out simultaneously.

18.2 Check of the manufacturer's documentation

The following checks for formal consistency and compliance shall be made for all ports

- approved sentences against IEC 61162
- proprietary sentences against IEC 61162
- usage of fields as required for different functions including provided default values or settings transmission intervals against IEC 61162

The following checks for compliance with RS-232

- output drive capability (50 feet maximum).
- load on the line of inputs

18.3 Test of high speed output

Method of measurement

Set-up standard test environment and simulate VDL-position reports using test system. Record output from the EUT high-speed port. Refer to Table 14.1.

Required results

Verify that the recorded message contents agree with the simulated VDL contents (VDM) and own transmitted data (VDO) and in accordance with the sentence specifications of IEC 61162-1.

18.4 High speed output Interface performance

Method of measurement

Set-up standard test environment and operate EUT in normal mode. Increase the VDL load to >90%. Record transmitted messages and check PI output of EUT on port for "external Display" and ”auxiliary Display”.

Required results

Confirm that EUT outputs all received messages to the PI. Repeat test for port "auxiliary display".

18.5 Test of high speed input

18.5.1 VDM input

Method of measurement

Set up standard test environment. Apply simulated VDM input data, in accordance with the sentence specifications of IEC 61162-1 input to the EUT and record VDM retransmissions on VDL output.

Required results

Verify that each VDM input is transmitted once and the VDL message contents agree with simulated input data.

18.5.2 Specific base station sentences

Method of measurement

Set up standard test environment. Apply simulated input data, in accordance with the sentence specifications of IEC 61162-1 and, input to the EUT and record VDL output. Refer to Table 14.3.

Required results

Verify that the VDL message contents agree with simulated input data.

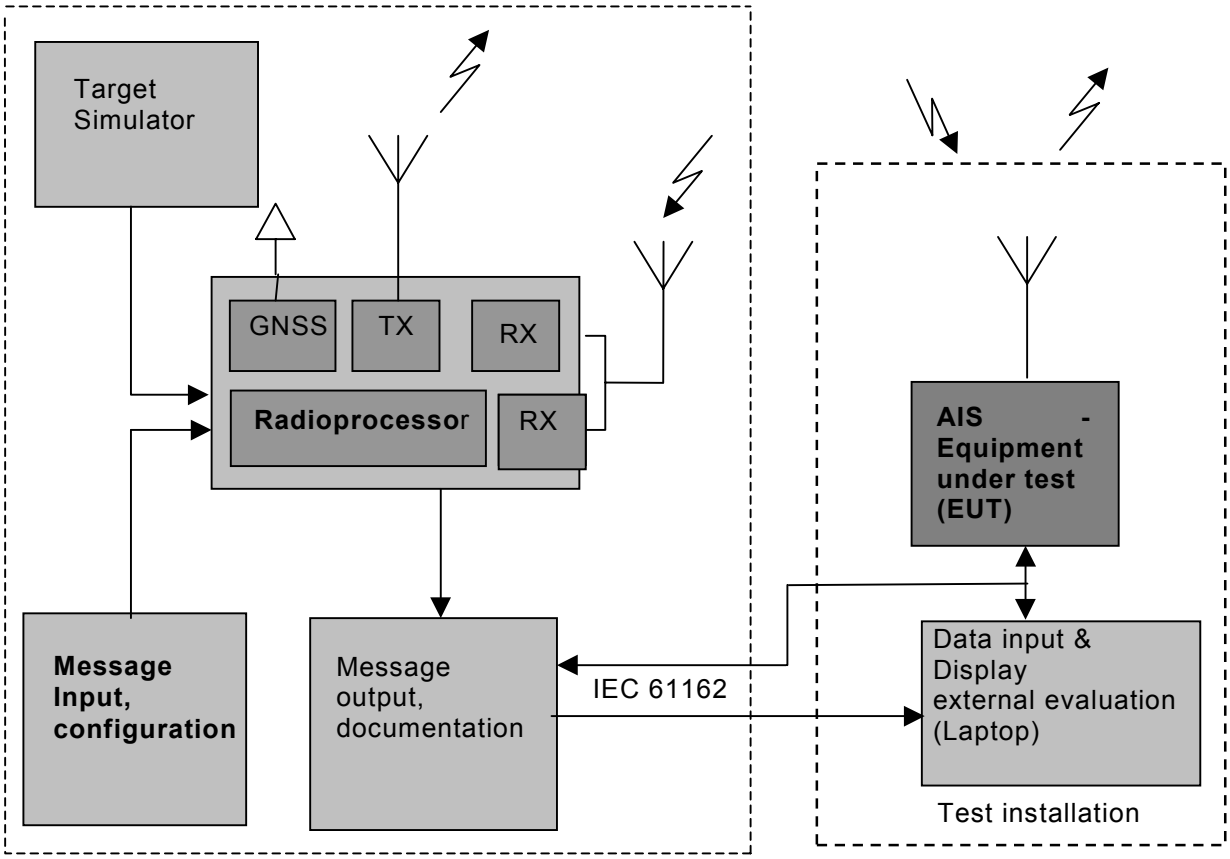


Figure 16 - Block diagram of AIS test system

Part B -AIS Simplex Repeater

19 Introduction

The AIS Simplex Repeater station needs to perform in accordance with the Recommendation ITU-R M.1371-1 and the IALA Technical Clarifications (latest edition) in order to maintain harmony with the AIS system requirements.

This part describes the minimum functional requirements for AIS simplex repeater and for the dedicated AIS Simplex Repeater Station.

[M.1371-1] provides for AIS Simplex Repeating. Areas of application of AIS Simplex Repeating are described in the IALA AIS Guidelines, Volume I, Part 2. In principle, AIS Simplex Repeating results in a simplex repeating process being performed on the AIS VDL. This simplex repeating process can be achieved

- by a dedicated station, which is called AIS Simplex Repeater station, or
- by a simplex repeating functionality implemented as an option into an AIS Base Station, or
- by a simplex repeating functionality implemented in the Physical or even Logical AIS Shore Station level, employing the re-transmit capability of an AIS Base Station.

This Part B describes the AIS Simplex Repeater Proper. Repeating by a Physical or Logical Shore Station is described in Part A of this document.

Advantages and disadvantages of the three different solutions as well as application recommendations are also given in the IALA AIS Guidelines, Volume I, Part 2.

AIS Simplex Repeater Cautions

- AIS Simplex Repeaters double the VDL link load for AIS mobile stations and should only be used in low traffic density areas to extend RF coverage. The AIS Simplex Repeater without filtering should only be used when the VDL link load is less than 25% as a good rule of thumb. The AIS Simplex Repeater can be used at higher VDL link loads with sufficient repeat message filtering.

20 Functional requirements for the AIS Simplex Repeater

20.1 General AIS simplex repeater functional requirements

The AIS Simplex Repeater is a store and forward process in which a different time slot is used for retransmission. The retransmission could be on the same channel as that in which it was received (per ITU-R M.1084).

The AIS Simplex Repeater may apply filters to assist in reducing the amount of data to be repeated over the VDL. These filters could be those that acted upon such items as area, mobile station reporting rate and AIS message type.

The AIS Simplex Repeater can synchronise on any AIS station that has direct UTC.

An AIS Simplex Repeater should have modular construction. To that end it should have standardised interfaces (both hard- and software) including a Presentation Interfaced for configuration.

20.2 Functional Requirements for Simplex Repeater Retransmission Delay

The turn around time from receiving the message on the antenna port to retransmitting the message should be as short as possible and should not exceed four seconds.

20.3 Functional Requirements for Repeat Indicator for a Simplex Repeater

The simplex repeater should not change the content of the message, but should increment the repeat indicator by one (to a maximum of three) or set the repeat indicator to a pre-configured value. If the repeat indicator of the received message is set to three, the received message should not be repeated.

20.4 Functional Requirements for Communication State for the Simplex Repeater

The simplex repeater should not change the content of the message, but should change the SOTDMA communication state or ITDMA if relevant. The AIS Simplex Repeater should change the SOTDMA communication state as indicated in Table 26.

Table 26 – SOTDMA Communication State of Received Station

Received Parameter	Simplex Repeater Action
Synch State	Change to Synch State of Repeater
Slot Time Out	Set to zero
Slot Offset	Set to zero

The AIS Simplex Repeater should change the ITDMA Communication State as indicated in Table 27.

Table 27 – ITDMA Communication State of Received Station

Received Parameter	Simplex Repeater Action
Synch State	Change to Synch State of Repeater
Slot Increment	Set to zero
Number of Slots	Set to zero
Keep Flag	Set to FALSE (= 0)

20.5 Functional Requirements for Repeating Messages 16 and 20

When repeating messages 16 and 20 the slot offset value inside the messages should be recalculated by the simplex repeater to ensure the correct VDL response.

20.6 Functional Requirements for Error Checking for the Simplex Receiver

The AIS Simplex Repeater should perform error checking to verify a valid message prior to retransmission.

20.7 Functional Requirements for the Access Scheme

The AIS Simplex Repeater should use FATDMA reserved slots for all repeated messages. If this is not possible, the RATDMA access scheme may be used.

FATDMA slots can be reserved by means of one of the following two methods:

- The AIS Simplex Repeater transmits Message 20 to reserve FATDMA slots. In order to do this, the competent authority needs to configure the AIS Simplex Repeater with an MMSI number, an FATDMA allocation table and a report rate for VDL Message 20. This should be done using the following standard PI sentences:
  - CBM: Configuration of the report rate of VDL Message 20
  - DLM: FATDMA allocations
  - BCF: Other "base" station configuration parameters as applicable such as MMSI number
- The AIS Simplex Repeater FATDMA allocations can be made by an AIS Base Station on behalf of the AIS Simplex Repeater. In this case, the AIS Simplex Repeater should be notified of its FATDMA slot reservations for its use by the PI interface.

20.8 Functional Requirements for Regional Adaptations

The AIS Simplex Repeater radio parameters could be additionally subject to more stringent local/regional requirements.

20.9 Required Parameter Settings for the Physical Layer of the AIS Simplex Repeater Station

The following parameters are required for an AIS Simplex Repeater station. The Tables 28 to 30 are derived from Recommendation ITU-R M.1371-1, Annex 2. For the meaning of the symbols and additional information (footnotes) refer to the appropriate section of Recommendation ITU-R M.1371-1, Annex 2.

Table 28: Required parameter settings for an AIS Simplex Repeater station (part 1)

Symbol	Parameter Name	Low setting	High setting
PH.RFR	Regional frequencies	156.025 MHz	162.025 MHz
PH.CHS	Channel spacing	12.5 kHz	25 kHz
PH.AIS1	AIS 1 (default channel 1)	161.975 MHz	161.975 MHz
PH.AIS2	AIS 2 (default channel 2)	162.025 MHz	162.025 MHz
PH.CHB	Channel bandwidth	Narrow	Wide
PH.BR	Bit rate	9 600 bps	9 600 bps
PH.TS	Training sequence	24 bits	24 bits
PH.TST	Transmitter settling time (Transmit power within 20% of final value, Frequency stable to within ± 1.0 kHz of final value)	≤ 1.0 ms	≤ 1.0 ms
PH.TXP	Transmit output power (± 20%)	2 Watt	12.5 Watt

In addition, the constants of the physical layer of the AIS Simplex Repeater station should comply with the values given in the Tables 26.4 and 26.5.

Table 29 - Required Settings of Physical Layer Constants (part 2)

Symbol	Parameter name	Value
PH.DE	Data encoding	NRZI
PH.FEC	Forward error correction	Not used
PH.IL	Interleaving	Not used
PH.BS	Bit scrambling	Not used
PH.MOD	Modulation	Bandwidth adapted; GMSK/FM

Table 30 - Bandwidth dependent parameters of the Physical Layer of the AIS Simplex Repeater Station

Symbol	Parameter name	PH.CHB / Narrow	PH.CHB / Wide
PH.TXBT	Transmit BT-product	0.3	0.4
PH.RXBT	Receive BT-product	0.3/0.5	0.5
PH.MI	Modulation Index	0.25	0.50

20.10 Requirements and recommendations for the TDMA Receivers of the AIS Simplex Repeater Station

The technical characteristics as specified in Table 31 should apply to the TDMA receivers. The requirements indicated by (*) are compulsory for all AIS Simplex Repeater Stations, while all other parameters are recommended as a minimum. They may be subject to further regional requirements.

Table 31 - Required and recommended receiver characteristics

Receiver Parameters	25kHz channels	12.5kHz channels
Sensitivity (*)	20% PER for –107 dBm	20% PER for –98 dBm
Co-channel rejection	-10 – 0 dB	-18 – 0 dB
Adjacent channel selectivity	70 dB	50 dB
Spurious response rejection	70 dB	N/A
Intermodulation response rejection and Blocking	20 % PER	N/A

20.11 Shutdown Procedure for an AIS Repeater station

An automatic transmitter hardware shutdown procedure and indication should be provided in case the transmitter does not discontinue its transmission within 1 second from the start of the repeated message.

21 Functional Block Diagram of an AIS Simplex Repeater Station

Figure 27.1 shows the functional block diagram of an *AIS simplex repeater station*. The components in dotted lines or the input data in parenthesis are optional.

These functional elements of the *AIS simplex repeater station* are required (compulsory) in the minimum configuration of an *AIS simplex repeater station*:

- One TDMA receiver

- One TDMA transmitter
- A controlling unit
- A Built-In-Integrity-Test unit (BIIT)
- A power supply

The following functional elements are optional to the *AIS simplex repeater station*:

- A Presentation Interface (PI): The Presentation Interface allows to output data from the *AIS simplex repeater station* and to input data to the *AIS simplex repeater station*.
- An internal sync source

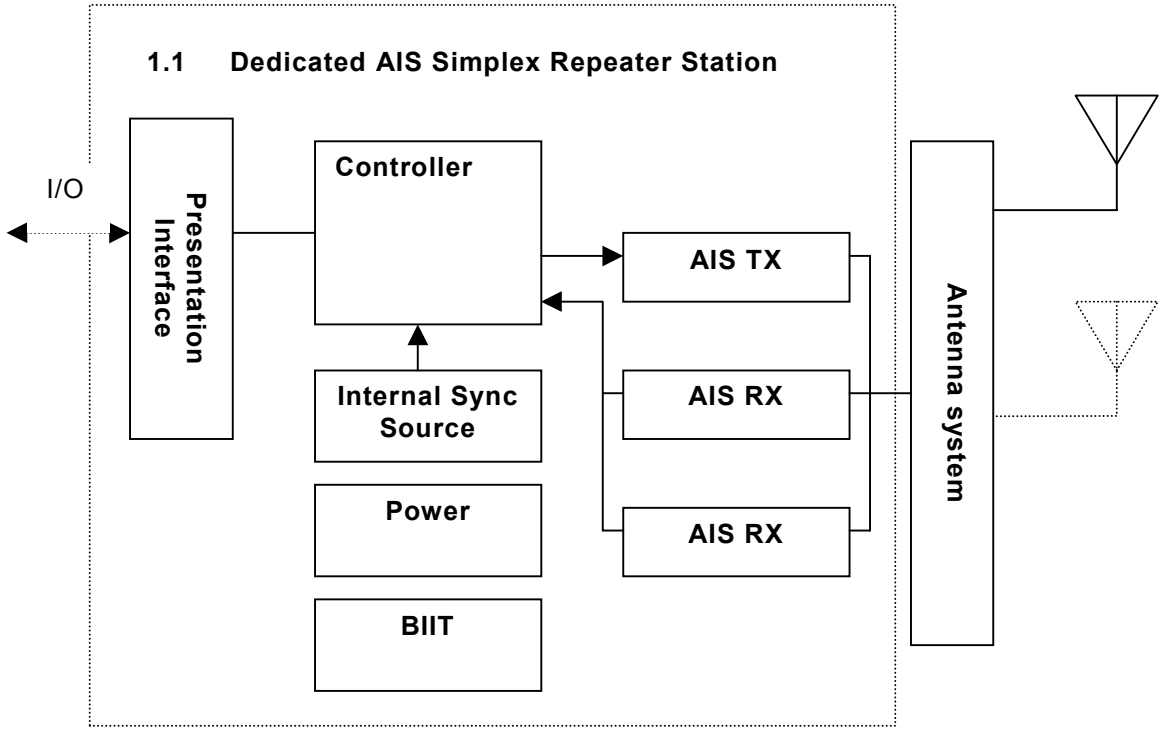


Figure 17 - Functional Block Diagram of a dedicated Simplex Repeater Station

21.1 General requirements for receiver and transmitter

The following general requirements apply to the receiver and transmitter respectively:

- An *AIS simplex repeater station* should operate on simplex channels (Recommendation ITU-R M.1371-1, Annex 1).
- An *AIS simplex repeater station* should be capable of 25 kHz and 12.5 kHz emission / reception in accordance with ITU-R M.1084-2, Annex 3 (as referenced by Recommendation ITU-R M.1371-1). However, bandwidth agility is not required during normal operation.
- The *AIS simplex repeater station* should be capable to transmit at low or high power, as stated in *[M.1371-1]* and *[Technical Clarifications]*. However, power control is not required during normal operation.

22 Performance tests for AIS Simplex Repeater Station

22.1 Performance tests for the interface to the AIS VDL

- Receiver Sensitivity

- Co-Channel Rejection
- Adjacent Channel Selectivity
- Spurious Response Rejection
- Intermodulation Response Rejection and Blocking
- Transmitter Power
- Frequency Stability
- Slot Access

23 Configuration of Simplex Environments / Repeaters

The following parameters should be configurable for an AIS Simplex Repeaters station:

- Operational Channel
- Channel Bandwidth
- Transmitter Output Power
- Channel Load Threshold
- Filtering parameters
  - Coverage Area
  - Reporting Rate
  - Message Type
- Access Scheme
- Repeat Indicator

24 Requirements Traceability to ITU-R M.1371-1 for the AIS Simplex Repeater Station

The following tables indicate how a certain paragraph of Recommendation ITU-R M.1371-1 (together with appropriate IALA Technical Clarifications), indicated by the paragraph number, applies to the AIS Simplex Repeater station.

For the AIS Simplex Repeater Station, there are 4 columns showing the applicability, where '**x**' indicates that the section/paragraph is applicable. When there are sub-paragraphs, the symbol '@' indicates, that the requirement also includes all subparagraphs. The meaning of the 4 applicability columns is:

C Compulsory in any configuration

N Not allowed; must not be done or used or output

R Recommended, but not part of minimum requirements

O purely Optional

Table 32: Mapping Physical Layer

Annex/ Para of M.1371-1	Short description	Simplex Repeater Station				Remarks
		C	N	R	O	
A2, 2	Physical layer	x				
A2, 2.1.1	Physical layer, Parameters, General,	x				

Annex/ Para of M.1371-1	Short description	Simplex Repeater Station				Remarks
		C	N	R	O	
A2, 2.1.2 A2, 2.1.3	Constants and Bandwidth except Table 2 PH.TXP					
A2, 2.1.1	Table 2 PH.TXP High setting of transmit output power	x				
	Table 2 PH.TXP Low setting of transmit output power	x				
A2, 2.1.4	Transmission media	x				
A2, 2.1.5	Dual channel operation, 2 receivers	x				
	Transmission on 2 frequencies	x				
A2, 2.2	25 kHz or 12.5 kHz setting	x				
A2, 2.3	Transceiver characteristics	x				
A2, 2.4 @	Modulation scheme	x				
A2, 2.5	Data transmission bit rate	x				
A2, 2.6	Training sequence	x				
A2, 2.7	Data encoding	x				
A2, 2.8	Forward error correction	x				
A2, 2.9	Interleaving	x				
A2, 2.10	Bit scrambling	x				
A2, 2.11	Data link sensing	x				
A2, 2.12 @	Transmitter settling time	x				
A2, 2.13 @	Transmitter power high or low	x				
A2, 2.14 @	Shutdown procedure within 1.0 sec	x				
A2, 2.15	Safety precautions	x				

Legend for each message as described in [M.1371-1],A2, 3.3.8.2.1…18:

G Generate the message and transmit

R Receive, process and internal use of the message

P Presentation interface output

T Transmit by repeater station after receiving it (repeat).

V Transmit if VDM sentence is received

Table 33: Mapping Link Layer

Annex, Para of M.1371-1	Short description	Simplex Repeater Station				Remarks
		C	N	R	O	
A2, 3	***Link layer***	x				
A2, 3.1	***Sublayer 1*** Medium Access Control (MAC)	x				
A2, 3.1.1	TDMA synchronization, 1st	x				

Annex, Para of M.1371-1	Short description	Simplex Repeater Station				Remarks
		C	N	R	O	
	paragraph					
	MAC SyncBaseRate		x			
	MAC SyncMobileRate		x			
A2, 3.1.1.1	UTC direct	x				
A2, 3.1.1.2	UTC indirect	x				
A2, 3.1.1.3	Synchronized to base station	x				1) although 3.1.1.3 is only applicable for mobile stations, a simplex repeater station should be allowed to synchronise to a base station as described in 3.1.1.3. See also Section 20.4.
A2, 3.1.1.4	Number of received stations except being able to become semaphore	x				2) A simplex repeater station should not change the number of received stations value.
	Being able to become semaphore		x			
A2, 3.1.2	Time division	x				
A2, 3.1.3.1	Slot phase synchronization	x				
A2, 3.1.3.2	Frame synchronization	x				
A2, 3.1.3.3	Synchronization Transmitting stations		x			
A2, 3.1.3.3.1	Base station operation		x			
A2, 3.1.3.3.2	Mobile station operation as a semaphore		x			
A2, 3.1.3.4 @	Synchronization Receiving stations	x				
A2, 3.1.4	Slot identification	x				
A2, 3.1.5	Slot access	x				
A2, 3.1.6	Slot state	x				
A2, 3.2 @	***Sublayer 2*** Data link services (DLS)	x				
A2, 3.3	***Sublayer 3*** Link management entity (LME)	x				
A2, 3.3.1 @	Access to data link	X				3) Only FATDMA or RATDMA can be used for a simplex repeater.
A2, 3.3.2	Modes of operation	**Not Applicable**				4) Simplex repeater does not generate its own messages, and therefore the modes of operation are not applicable
A2, 3.3.2.1	Autonomous and continuous	**Not Applicable**				
A2, 3.3.2.2	Assigned	**Not Applicable**				
A2, 3.3.2.3	Polled	**Not Applicable**				
A2, 3.3.3	Initialization	x				
A2, 3.3.4	Channel access schemes	x				
A2, 3.3.4.1 @	ITDMA		x			
A2, 3.3.4.2 @	RATDMA	x				

Annex, Para of M.1371-1	Short description	Simplex Repeater Station				Remarks
		C	N	R	O	
A2, 3.3.4.3 @	FATDMA	**x**				
A2, 3.3.4.4 @	SOTDMA		**x**			
A2, 3.3.5 @	Autonomous and continuous operation using SOTDMA		**x**			5) A simplex repeater station is not operating in the autonomous mode
A2, 3.3.6 @	Assigned operation for mobile stations		**x**			6) According to this description, a base station or a repeater station may not be switched into assigned mode because they are not operating in the autonomous mode.
A2, 3.3.7	Message structure	**x**				
A2, 3.3.7.1	Message ID	**x**				
A2, 3.3.7.2 @	SOTDMA Message Structure	**x**				7) See Section 20.4
A2, 3.3.7.3 @	ITDMA Message Structure	**x**				8) See Section 20.4
A2, 3.3.7.4 @	RATDMA Message Structure	**x**				
A2, 3.3.7.5	FATDMA Message Structure	**x**				
A2, 3.3.8	Message types	**x**				
A2, 3.3.8.1	Message summary	**x**				
A2, 3.3.8.2	Message description	**x**				
A2, 3.3.8.2.1	Message 1, 2, 3 Position report	**R T**	**G**		**P**	
A2, 3.3.8.2.2	Message 4 Base station report	**R T**	**G**		**P**	9) If repeated by a simplex repeater, which is indicated by the repeat indicator, then the UTC given in these messages may not be accurate due to repeat delay.
	Message 11 UTC and data response	**R T**	**G**		**P**	
A2, 3.3.8.2.3 @	Message 5 Ship static and voyage related data	**R T**	**G**		**P**	
A2, 3.3.8.2.4 @	Message 6 Addressed binary message	**R T**	**G**		**P**	
A2, 3.3.8.2.5	Message 7 Binary acknowledgement Message 13 Safety related acknowledgement	**R T**	**G**		**P**	
A2, 3.3.8.2.6	Message 8 Binary broadcast message	**R T**	**G**		**P**	
A2, 3.3.8.2.7	Message 9 Standard SAR Aircraft Position report	**R T**	**G**		**P**	
A2, 3.3.8.2.8	Message 10 UTC time and data inquiry	**R T**	**G**		**P**	

Annex, Para of M.1371-1	Short description	Simplex Repeater Station				Remarks
		C	N	R	O	
A2, 3.3.8.2.9 3.3.8.2.10	Message 12 Addressed safety related message Message 14 Safety related broadcast message	**R T**	**G**		**P**	
A2, 3.3.8.2.11	Message 15 Interrogation	**R T**	**G**		**P**	10) Repeat only if slot offset = 0
A2, 3.3.8.2.12	Message 16 Assigned mode command	**R T**	**G**		**P**	11) Adjust content of message to reflect the correct offset value
A2, 3.3.8.2.13	Message 17 GNSS broadcast binary message	**R T**	**G**		**P**	12) System design should take into account the maximum delays allowed for repeating DGNSS corrections (Msg 17)
A2, 3.3.8.2.14	Message 18 Standard Cl B equipment position report	**R T**	**G**		**P**	
A2, 3.3.8.2.15	Message 19 Extended Cl B equipment position report	**R T**	**G**		**P**	
A2, 3.3.8.2.16	Message 20 Data link management message	**R T G**			**P**	13) Adjust content of message to reflect the correct offset value
A2, 3.3.8.2.17	Message 21 Aids-to-navigation report	**R T**	**G**		**P**	
A2, 3.3.8.2.18	Message 22 Channel management	**R T**	**G**		**P**	

24.1.1 Network Layer functionality as required / prohibited for AIS Simplex Repeater stations

The following table maps the Network Layer paragraphs of Recommendation ITU-R M.1371-1 (together with appropriate sections of IALA Technical Clarifications) to the AIS Simplex Repeater station.

Table 34: Mapping Network Layer

Annex, Paragraph of M.1371-1	Short description	Simplex Repeater Station				Remarks
		C	N	R	O	
A2, 4	***Network layer***	x				
A2, 4.1	Dual channel operation Except Msg 22 commands	x				1) Receiving Msg 22 not applicable for simplex repeater station
A2, 4.1	Msg 22 commands	**Not Applicable**				
A2, 4.1.1	Operating frequency channels	x				2) Compulsory in general but channel selection is done by configuration

Annex, Paragraph of M.1371-1	Short description	Simplex Repeater Station				Remarks
		C	N	R	O	
						sentences only. There is no requirement for storing received regional operating settings.
A2, 4.1.2	Normal default mode of dual channel operation	x				
A2, 4.1.3	Regional operating frequencies	x				3) configuration
A2, 4.1.4	Regional operating areas		**x**			4) These rules apply for mobile stations only.
A2, 4.1.5	Transitional mode operations near regional boundaries		**x**			5) A simplex repeater station should only operate in one designed area and is not subject to move via transition to another area.
A2, 4.1.6	Channel management switch by manual input	**Not Applicable**				
A2, 4.1.7	Resumption of operation after power on	**Not Applicable**				
A2, 4.1.8	Priority of channel management commands	**Not Applicable**				
A2, 4.1.9	Conditions for changing both AIS operational frequency channels	**Not Applicable**				
A2, 4.2.1	Distribution of transmission packets – The User Dictionary	x				
A2, 4.2.2	Distribution of transmission packets – Routing of transmission packets		**x**			
A2, 4.2.3	Distribution of transmission packets – Management of Priority Assignments for Messages		**x**			
A2, 4.3 @	Reporting rates	**Not Applicable**				
A2, 4.4	Data link congestion resolution	x				
A2, 4.4.1	Intentional slot reuse by own station	x				
A2, 4.4.2	Use of assignment for congestion resolution	**Not Applicable**				
A2, 4.5	Base station operation		**x**			6) base station functions are not **additional** to mobiles
A2, 4.6	Repeater operation	x				
A2, 4.6.1.1	Repeat indicator (Mobile use)	**Not Applicable**				
A2, 4.6.1.2	Repeat indicator (Base/repeater station use)	x				7) Simplex repeater station should increment the value of the repeat indicator as described in 4.6.1.2.1
A2, 4.6.1.2.1.	Number of repeats	x				
A2, 4.6.2	Duplex repeater mode		**x**			
A2, 4.6.3 @	Simplex repeater mode	x				
A2, 4.7	Handling errors related to packets	**Not Applicable**				8) The simplex repeater does not generate any messages and they are not giving a message a sequence number.

24.1.2 Transport Layer functionality as required / prohibited for AIS Simplex Repeater stations

The following table maps the Transport Layer paragraphs of Recommendation ITU-R M.1371-1 (together with appropriate sections of IALA Technical Clarifications) to the AIS Simplex Repeater station.

Table 35: Mapping Transport Layer

Annex, Paragraph of M.1371-1	Short description	Simplex Repeater station				Remarks
		C	N	R	O	
A2, 5.1	Transmission packet				x	
A2, 5.2 @	Conversion				x	
A2, 5.3.1	Addressed message	Not Applicable				
A2, 5.3.2	Broadcast message	Not Applicable				
A2, 5.3.3	Conversion to presentation interface				x	
A2, 5.4	Presentation interface protocol				x	
A3 @	***DSC***	Not Applicable				
A4 @	***Long range***	Not Applicable				
A5 @	***Application specific messages***	Not Applicable				
A6 @	***Sequencing of transmission packets***	Not Applicable				

25 Integration of an AIS simplex repeating functionality into an AIS base station

It is allowed to integrate AIS Simplex repeater process into an AIS Base Station. In such a case, all of the requirements from this Chapter II-B should be adhered to.annex B: Interfacing the DGNSS Correction Service to The AIS Base Station

Annex A
(Informative)
Interfacing the DGNSS Correction Service to The AIS Base Station

A.1 Functional

Figure A1 shows a functional flow chart about the interfacing between the GNSS correction data source and the AIS mobile station connected to an (D)GNSS receiver.

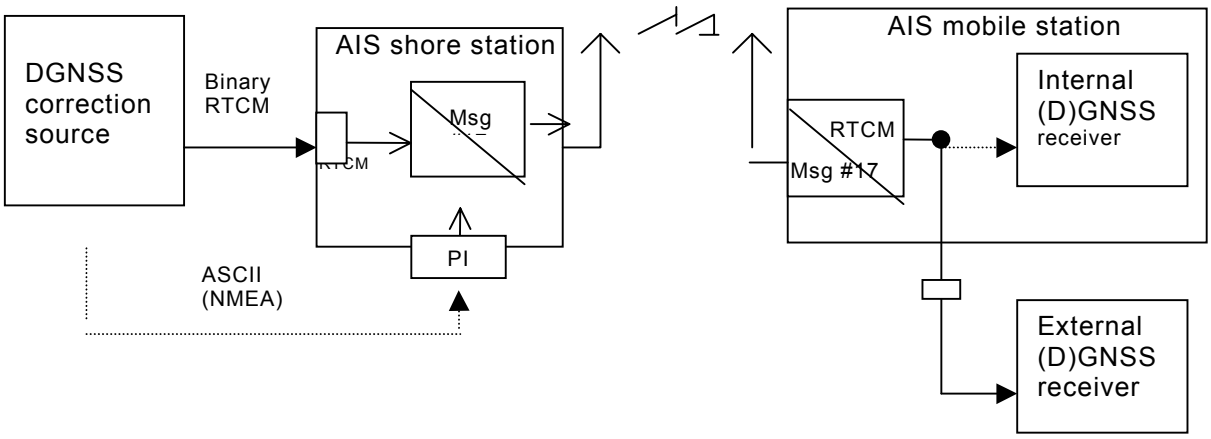


Figure A1: Functional flow chart

Depending on the used DGNSS correction data source (as described in Chapter 2) it can be advantageous to connect the correction data via a binary or via an ASCII interface to the AIS base station.

For solutions where the RTCM output interface of an external DGNSS reference station or a MF beacon receiver is used, it is beneficial to connect the output port directly to a binary RTCM input port of the AIS base station.

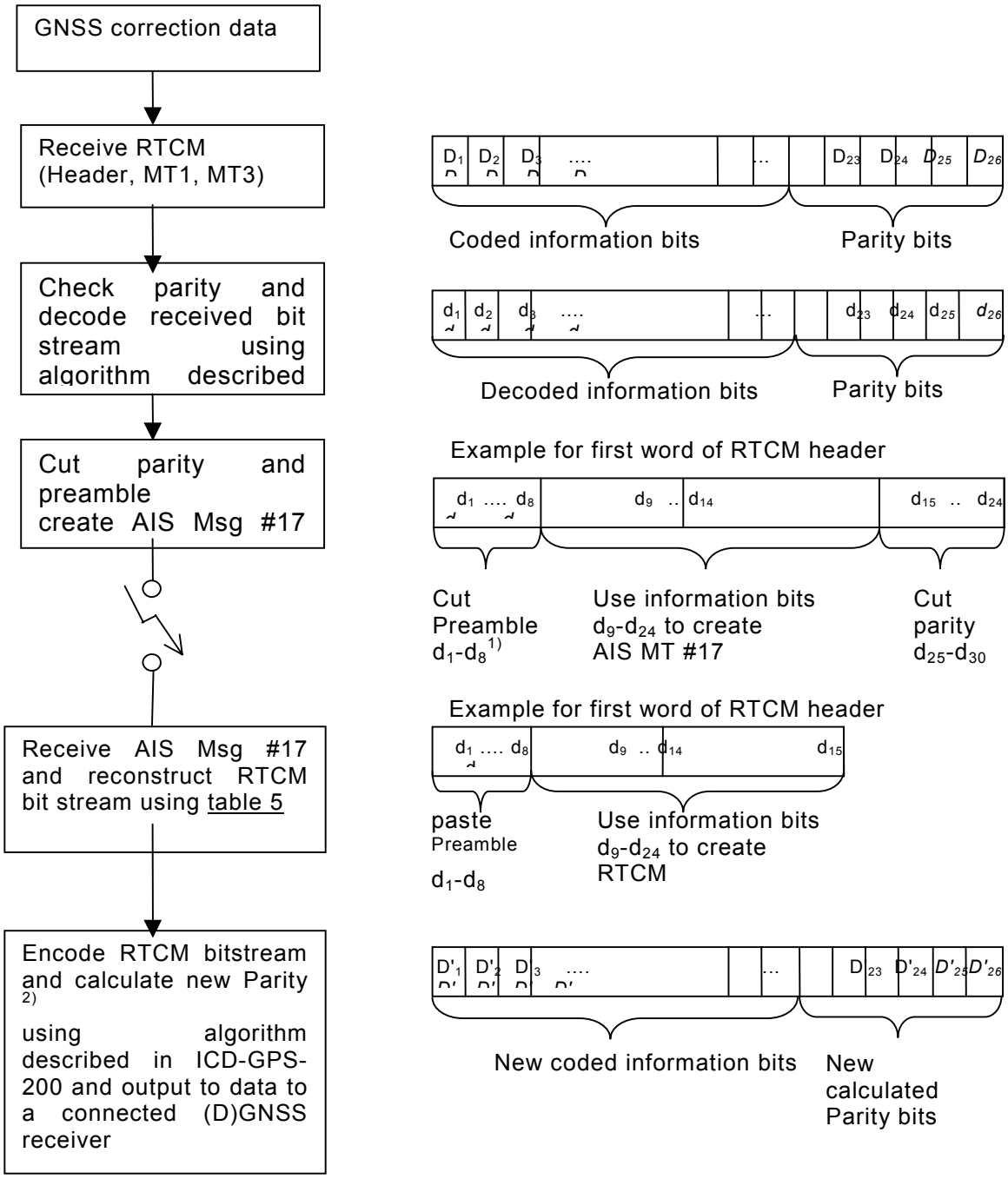
The interface is described in detail in the ITU-R M.823 Data Interface Specification (Annex 2). In this case the conversion to VDL Message 17 is done inside the base station, so that no further adaptation between the DGNSS data source and the base station is needed.

In the case that an external DGNSS source is used, that is connected via a network (LAN/WAN), it could be useful to handle the correction data in ASCII format and feed the data via the presentation interface into the AIS base station.

The conversion of the correction data into an appropriate VDL Message 17 is done outside the AIS base station. The input to the presentation interface occurs as IEC 61162-1 VDM sentence with the encapsulated VDL Message 17 data.

A.2 Processing the Received DGNSS Correction Data

Figure B2 shows a flow chart that describes the logical flowing of decoding and encoding the RTCM data stream and the appropriate AIS Message #17.



1) The preamble is only cut in the first word of the RTCM header. Normally d_1-d_{24} are used to create AIS Msg #17

2) Normally bits D_{29} and D_{30} of the previous word is used to calculate D'_1 to D'_{30} of the new RTCM data word. For initialisation D_{29} and D_{30} can set to '0'.

Figure A2: Logical flow chart

Table A1 provides information how to create AIS Msg #17.

Table A1

AIS Msg #17	Data source
Static data	

Parameter	Number of Bits	
Message ID	6	Set by AIS shore station
Repeat Indicator	2	Set by AIS shore station
Source ID	30	Set by AIS shore station
Spare	2	-
Longitude	18	Set by AIS shore station (refer to remark below)
Latitude	17	Set by AIS shore station (refer to remark below)
Spare	5	-
Differential Correction data (header)		
Parameter	**Number of Bits**	
Message Type	6	RTCM Header, Word1, d_9-d_{14}
Station ID	10	RTCM Header, Word1, d_{15}-d_{24}
Z count	13	RTCM Header, Word2, d_1-d_{13}
Sequence number	3	RTCM Header, Word2, d_{14}-d_{16}
N	5	RTCM Header, Word2, (d_{17}-d_{21}) - 2 [1)]
Health	3	RTCM Header, Word2, d_{22}-d_{24}
Differential Correction data (example for the 1st satellite)		
Scale factor	1	RTCM Header, Word3, d_1
UDRE	2	RTCM Header, Word3, d_2-d_3
Satellite ID	5	RTCM Header, Word3, d_4-d_8
PRC	16	RTCM Header, Word3, d_9-d_{24}
RRC	8	RTCM Header, Word4, d_1-d_8
Issue of data	8	RTCM Header, Word4, d_9-d_{16}
Fill bits	8 (or 16) [2)]	RTCM Header, Word4, d_{17}-d_{24}
[1)]The frame length in RTCM header is two more than the number of words (N) following the header [2)]16 fill bits are used for RTCM word $_{(N+2)}$ if number of satellites Ni = 2,5,8 or 11		

Remark

One of the elements used in AIS Msg #17 is the reference station position.

Within the IALA DGNSS MF Beacon System the reference station position will enable a beacon receiver to select the nearest, healthy reference station when in automatic mode.

To select the nearest, healthy station the beacon receiver need to be connected to a GNSS receiver to get the current position. An algorithm is implemented in the beacon receiver that calculates the distance between the receiver and the reference station and takes care of the health status and signal quality of the received correction.

If an AIS mobile station is able to receive more than one source of DGNSS corrections via Msg 17a similar algorithm is needed within the AIS mobile station. Annex B (based on IEC 61108-4) describes such an algorithm

A.3 Electrical Interfacing

Table A2 shows the electrical requirements.

Table A2

Interface	Electrical protocol
AIS shore station (see figure 8) (RTCM input)	RS 232 RS 422 LAN, TCP/IP
AIS mobile station (see figure 8) (RTCM output)	RS 422 RS 232

Annex C to this paper provide a “Data interface guidance”. This Annex is part of IEC 61108-4 and describes information about the RTCM digital data enters and exits through an asynchronous full duplex serial input/output port.

A.4 DGNSS correction data administration within the AIS base station

Figure A3 shows the data flow from the DGNSS data source up to the transmission within the AIS base station.

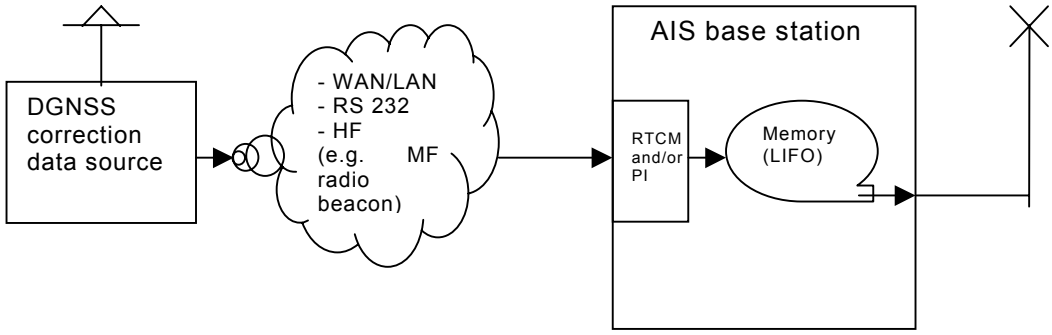


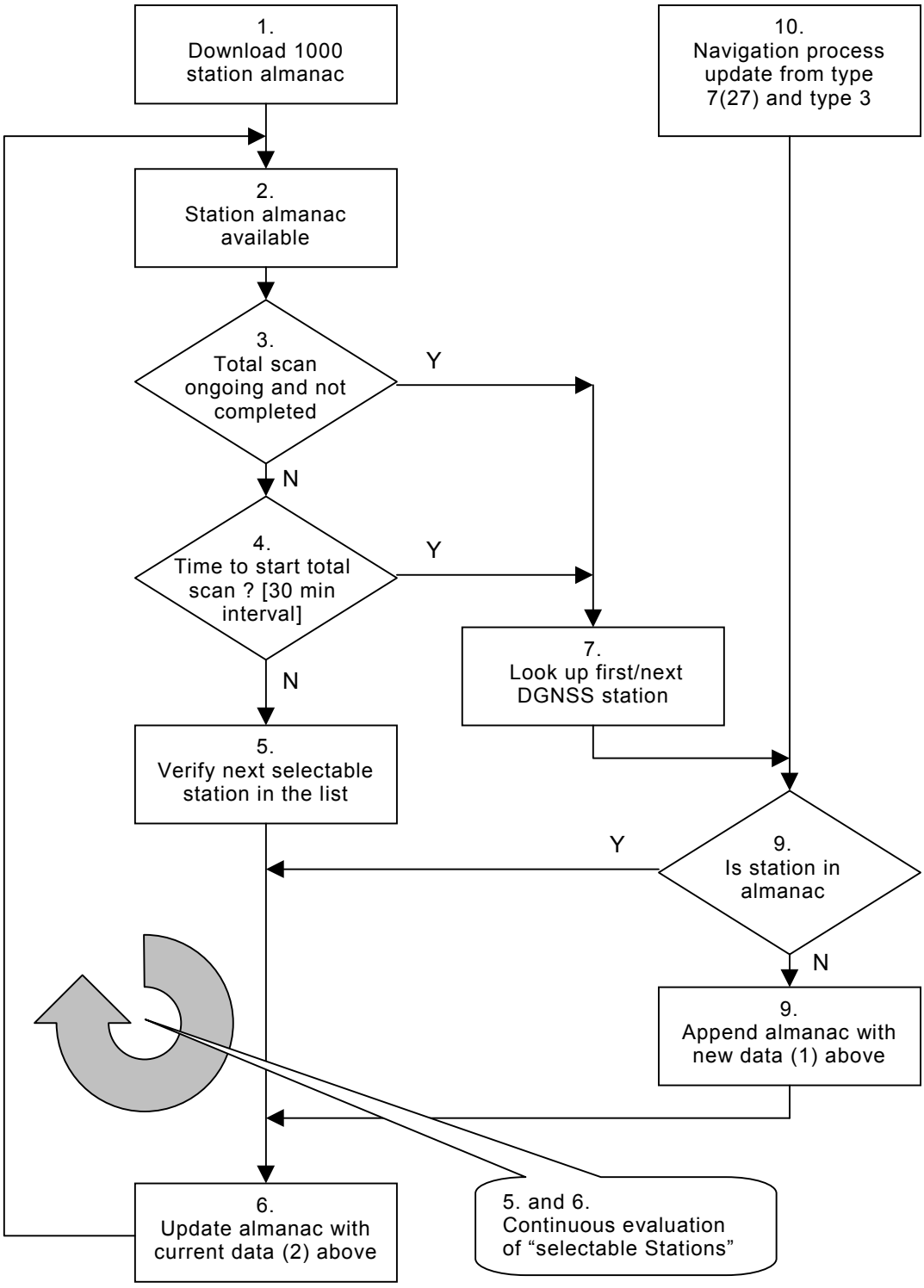
Figure A3 - Functional flow chart

The reference receiver generates corrections with a high update rate. Normally a complete set of corrections is available each second.

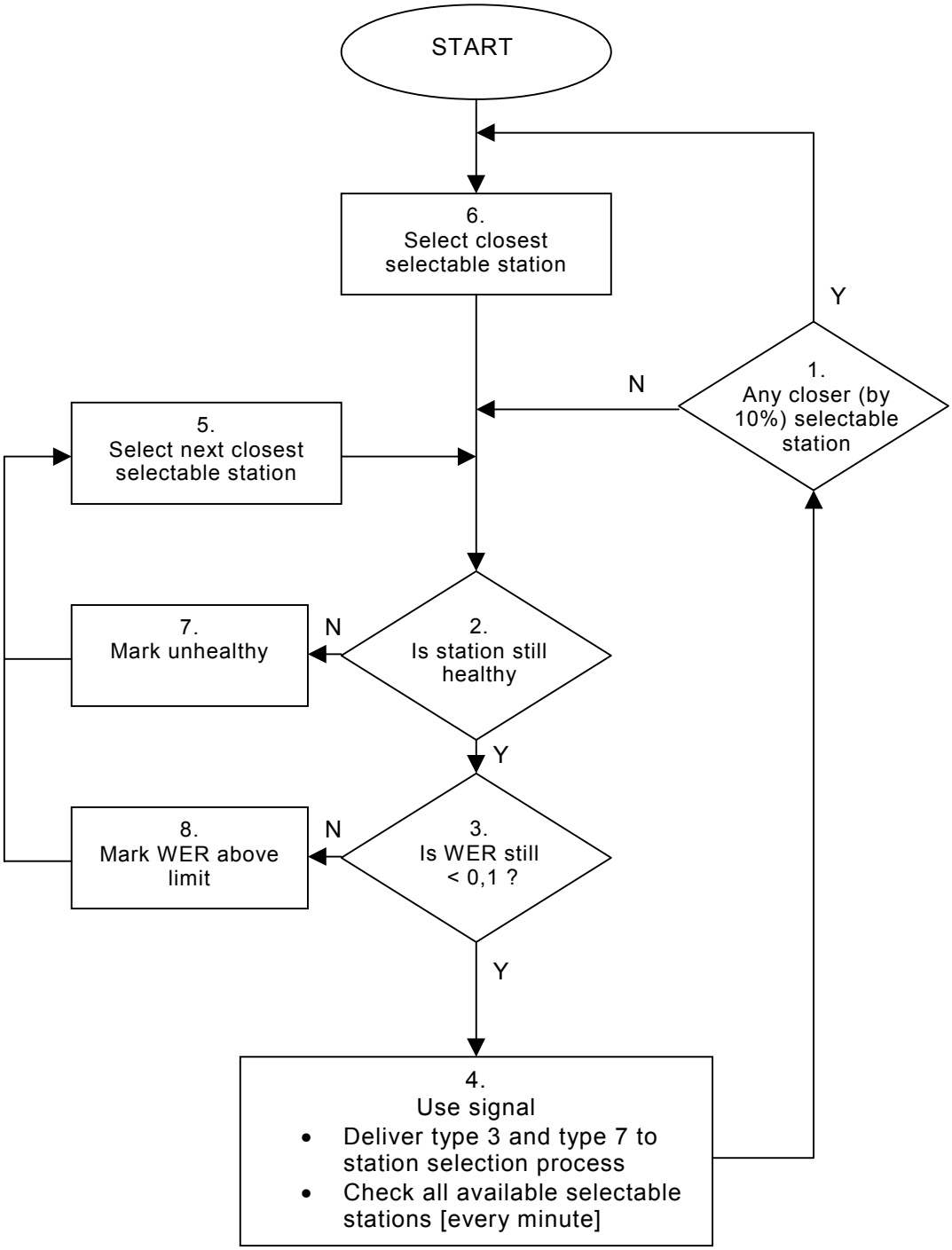
Dependent on the used communication link the data will be available at the AIS base station with a latency of 1 to 6 seconds. As described in chapter 3 the AIS base station will transmit the AIS VDL Message 17 within 3 time slots with a repetition interval of ≤ 5 seconds. To fulfil the demands of integrity and accuracy it is important that the AIS base station will always use the most topical set of correction data that is available at that time.

Annex B
(informative)
Implementation using a Concurrent Process

B.1 Station Status Update



B.2 Navigation process



Annex C
(informative)
DATA INTERFACE GUIDANCE
RTCM Input/Output in Binary Format

ITU-R M.823 Data Interface Specification: The GNSS equipment shall be designed in such a way that the ITU-R M.823 digital data link information enters and exits through an asynchronous full duplex serial input / output port.

The American National Standards Institute (ANSI) X3.16(4) and X3.15(5) standards for eight-bit character structure shall govern the rules for serial data transfers. Note that the use of all eight bits in the transfer of serial data precludes the use of 7 bit parity formats. The recommended protocol being 8 bits, no parity, 1 stop bit. The serial data rate shall be selectable at least over the 1200 to 9600 baud range (1200, 2400, 4800, or 9600 baud).

Important Interface Rules: Although the data is packaged in 8-bit bytes, the interpretation of what each of the 8 bits means is dictated by a combination of what is presented in ITU-R M.823 and the rules that follow.

Byte Format Rule: A standard 8-bit byte is described as the “8-Bit Environment” in ANSI X3.16(4). This standard assigns the order of the start, stop, and eight data bits: the first data bit transmitted is designated “a8” and the last is “a1”; bit “a1” is designated the least significant bit. This is a source of problems and is discussed in the next section (see - Most Significant Bit First Rule). All equipment shall support the use of the “6 of 8” format (data bits a1 through a6) to transfer the information contained in ITU-R M.823. As an indication that bits a1 through a6 are “message information”, bit a7 shall be set “marking” and a8 shall be set “spacing”. The appropriate mark and space signalling conditions are discussed in ITU-T V.28 (RS232) and ITU-T V.11 (RS422).

Most Significant Bit First Rule: The Data Link binary information shall always be passed in the order it appears in ITU-R M.823. This is known as most significant bit first. Unfortunately, the ANSI X3.15-1976 standard states that the least significant bit is first. Almost all integrated circuits designed for serial communications follow this convention. The use of X3.15 standard Universal Asynchronous Receivers and Transmitters (UARTs) introduces the need for a “byte roll” prior to leaving the reference station equipment and then again just after entering the GNSS user equipment. The following is from ANSI standard X 3.15-1976(5): “The bit sequence for an ASCII nomenclature (6) b1 through b7 in ascending (consecutive) order, or in terms of the 8-bit nomenclature (7) a1 through a8 in ascending (consecutive) order.”

The “roll” process is performed on each byte prior to transmission. Rolling means that bits a1 and a6, a2 and a5, a3 and a4 are swapped. This same process is repeated after user equipment accepts each byte.

Bit Slip Rule: In a typical installation the communications receiver or modem will assemble the received bits into 8-bit bytes. No specific (except bit synchronisation) byte or “word” synchronisation should be assumed. The user equipment shall be required to recover the message synchronisation just as it is responsible for recovering the synchronisation of the satellite navigation data. This simply means that the user equipment designer should not assume there will be any consistent relationship between the word boundaries of this standard’s 30 bits words and the communications channel 8 bit bytes.

Annex D
(Informative)
Format definition of input / output sentences specifically defined for AIS base stations in accordance with the data structures of IEC 61162-1

D.1 Presentation Interface Data Templates

D.1.1 ACM – Preparation and Initiation of An AIS Base Station Broadcast of an Addressed Channel Management Message (ITU-R M.1371 Message 22)

Description	Detail	Notes
Recommended sentence formatter	**ACM**	**Three alphanumeric characters**
Long Sentence Name	Command to a Base station to broadcast an "Addressed" Channel Management message, AIS VDL message 22	
Talker Identifier(s)	AS	AS = AIS Shore Station BS = AIS Base Station
Query Enabled	No	Yes or No
Use linked to another sentence formatter	No	Yes or No
Describe linkage	nil	
Multiple line sentence	No	Yes or No
Paragraph describing purpose and use of this sentence	This message is used to provide an AIS base station with the information it uses to broadcast an "addressed VDL message 22." This contains settings that are broadcast to the specified AIS station(s). Upon receiving this information, the base station should prepare and make the appropriate broadcast	
Field 1 description	MMSI of addressed station 1	
Type (and range)	fixed number field (10 digits)	
Maximum number of ASCII characters	10	
Units	none	
Special conditional values	null not allowed	Note: null indicates no change and/or unavailable
Field 2 description	MMSI of addressed station 2	
Type (and range)	fixed number field (10 digits)	
Maximum number of ASCII characters	10	
Units	none	
Special conditional values	null field if only one station is addressed	Note: null indicates no change and/or unavailable
Field 3 description	ITU-R M.1084 channel designation for "Channel A"	
Type (and range)	variable number (1-9999)	Note: must be selected by an administration in accordance with ITU-R M.1084, Annex 4
Maximum number of ASCII characters	4	
Units	none (Table lookup value)	
Special conditional values	null not allowed	Note: null indicates no change and/or unavailable
Field 4 description	Channel A bandwidth 0 = bandwidth is specified by channel number 1 = bandwidth is 12.5 kHz.	

Description	Detail	Notes
Type (and range)	variable number (0-1)	
Maximum number of ASCII characters	1	
Units	none (Table lookup value)	
Special conditional values	null not allowed	Note: null indicates no change and/or unavailable
Field 5 description	ITU-R M.1084 channel designation for “Channel B”	
Type (and range)	variable number (1-9999)	Note: must be selected by an administration in accordance with ITU-R M.1084, Annex 4
Maximum number of ASCII characters	4	
Units	none (Table lookup value)	
Special conditional values	null not allowed	Note: null indicates no change and/or unavailable
Field 6 description	Channel B bandwidth 0 = bandwidth is specified by channel number 1 = bandwidth is 12.5 kHz.	
Type (and range)	variable number (0-1)	
Maximum number of ASCII characters	1	
Units	none (Table lookup value)	
Special conditional values	null not allowed	Note: null indicates no change and/or unavailable
Field 7 description	TX/RX mode control 0 = transmit on channels A and B, receive on channels A and B 1 = transmit on channel A, receive on channels A and B 2 = transmit on channel B, receive on channels A and B	
Type (and range)	variable number (0-2)	
Maximum number of ASCII characters	1	
Units	none (Table lookup value)	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 8 description	Power level control 0 = high power 1 = low power	
Type (and range)	variable number (0-1)	
Maximum number of ASCII characters	1	
Units	none (Table lookup value)	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 9 description	Channel upon which base station should broadcast this message 22 0 = no broadcast channel preference 1 = broadcast on AIS channel A 2 = broadcast on AIS channel B 3 = broadcast two copies of the message – one on each channel	
Type (and range)	variable number (0-3)	
Maximum number of ASCII characters	1	
Units	none (Table lookup value)	

Description	Detail	Notes
Special conditional values	none	Note: null indicates no change and/or unavailable

D.1.2 ASN – Preparation and Initiation of an AIS Base Station Broadcast of Assignment VDL Message 16

Detailed DescriptionDescription	Detail	Notes
Recommended sentence formatter	**ASN**	Three alphanumeric characters
Long Sentence Name	Broadcast of an Assigned mode command message, AIS VDL message 16	
Talker Identifier(s)	AS	AS = AIS Shore Station BS = AIS Base Station
Query Enabled	No	Yes or No
Use linked to another sentence formatter	Yes (potential linkage to AQM)	Yes or No
Describe linkage	nil	
Multiple line sentence	No	Yes or No
Paragraph describing purpose and use of this sentence	This message is used to provide an AIS base station with the information it uses to broadcast an "assignment VDL message 16." This contains settings that are broadcast to the specified AIS station(s). Upon receiving this information, the base station should prepare and make the appropriate broadcast using the indicated "access scheme." (See ITU-R M.1371-1, §3.3.8.1, Message ID 16.)	
Field 1 description	MMSI of addressed station 1 (See NMEA DSC conventions, DSC formatter?)	
Type (and range)	fixed number field (10 digits)	
Maximum number of ASCII characters	10	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 2 description	Value of the "soft assigned" reporting rate for station 1	
Type (and range)	variable number (20-600)	
Maximum number of ASCII characters	3	
Units	none	
Special conditional values	The value is only used if Field 4 is set to 0	Note: null indicates no change and/or unavailable
Field 3 description	Value of the first assigned slot number for a station 1 in "hard assignment mode" i.e. value of increment (Field 4) is set to 0	
Type (and range)	variable number (0-2249)	
Maximum number of ASCII characters	4	
Units	none	
Special conditional values	The value is only used if Field 4 is ≠ 0	Note: null indicates no change and/or unavailable
Field 4 description	Value of "increment" command parameter for station 1 (See Clarifications Ed. 1.2, ITU-R M.1371-1, §3.3.8.2.12) 0 = reporting rate / 10 minutes = Field 2 1 = increment parameter is 1125 slots 2 = increment parameter is 375 slots 3 = increment parameter is 225 slots 4 = increment parameter is 125 slots 5 = increment parameter is 75 slots 6 = increment parameter is 45 slots	

Detailed DescriptionDescription	Detail	Notes
Type (and range)	variable number (0-6)	
Maximum number of ASCII characters	1	
Units	none (Table lookup value)	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 5 description	MMSI of addressed station 2 (See NMEA DSC conventions, DSC formatter?)	
Type (and range)	fixed number field (10 digits)	
Maximum number of ASCII characters	10	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 6 description	Value of the “soft assigned” reporting rate for station 2	
Type (and range)	variable number (20-600)	
Maximum number of ASCII characters	3	
Units	none	
Special conditional values	The value is only used if Field 8 is set to 0	Note: null indicates no change and/or unavailable
Field 7 description	Value of the first assigned slot number for a station 2 in “hard assignment mode” i.e. value of increment (Field 8) is set to 0	
Type (and range)	variable number (0-2249)	
Maximum number of ASCII characters	4	
Units	none	
Special conditional values	The value is only used if Field 8 is ≠ 0	Note: null indicates no change and/or unavailable
Field 8 description	Value of “increment” command parameter for station 2 (See Clarifications Ed. 1.2, ITU-R M.1371-1, §3.3.8.2.12) 0 = reporting rate / 10 minutes = Field 2 1 = increment parameter is 1125 slots 2 = increment parameter is 375 slots 3 = increment parameter is 225 slots 4 = increment parameter is 125 slots 5 = increment parameter is 75 slots 6 = increment parameter is 45 slots	
Type (and range)	variable number (0-6)	
Maximum number of ASCII characters	1	
Units	none (Table lookup value)	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 9 description	Channel upon which base station should broadcast this message 16 0 = no broadcast channel preference (use with care with hard assignment) 1 = broadcast on AIS channel A (use with hard assignment) 2 = broadcast on AIS channel B (use with hard assignment)	
Type (and range)	variable number (0-2)	
Maximum number of ASCII characters	1	
Units	none (Table lookup value)	
Special conditional values	[0 or null indicates no channel	Note: null indicates no change and/or

Detailed DescriptionDescription	Detail	Notes
	preferences and are valid only in “soft assignment” of reporting rate.]	unavailable

D.1.3 BCF – Base Station Configuration

Detailed Sentence LayoutDescription	Detail	Notes
Recommended sentence formatter	**BCF**	Three alphanumeric characters
Long Sentence Name	Base station Configuration	
Talker Identifier(s)	AS	AS = AIS Shore Station BS = AIS Base Station
Query Enabled	Yes	Yes or No
Use linked to another sentence formatter	no	Yes or No
Describe linkage	nil	
Multiple line sentence		Yes or No
Paragraph describing purpose and use of this sentence	This sentence is used to configure the static base station parameters when it is initially installed, and later in order to make changes to the way it operates. Dynamic parameters (e.g. UTC and position of a moving base station) are input in a different way. A system administrator will configure the base station. In addition, it is possible for an automated system to issue this sentence in order to change some parameter in response to a specified condition.	
Field 1 description	MMSI of the Base station	
Type (and range)	Fixed number field (10 digits)	
Maximum number of ASCII characters	10	
Units	None	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 2 description	Position source – Value 0 = surveyed position Value 1 = internal source Value 2 = external source	
Type (and range)	Variable number (0-15)	
Maximum number of ASCII characters	2	
Units	None (Table lookup values)	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 3 description	Latitude of base station with precision of 1/10000 minute.	
Type (and range)	llll.ll	
Maximum number of ASCII characters	10	
Units	degrees	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 4 description	N/S	
Type (and range)	string	
Maximum number of ASCII characters	1	
Units	none	

Detailed Sentence LayoutDescription	Detail	Notes
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 5 description	Longitude of base station with precision of 1/10000 minute	
Type (and range)	yyyyy.yy	
Maximum number of ASCII characters	11	
Units	degrees	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 6 description	E/W	
Type (and range)	string	
Maximum number of ASCII characters	1	
Units	None	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 7 description	Position accuracy (ref. ITU-R M.1371-1 message 4, 1 = high, 0 = low) Warning this field only applies when position source is “7” (survey)	
Type (and range)	Variable number	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 8 description	Receiver Channel number and bandwidth of operation of Channel A	
Type (and range)	variable number (1-9999) coding for this channel number follows the “simplex” channel and bandwidth conventions described in ITU-R M.1084, Annex 4	
Maximum number of ASCII characters	4	
Units	none (Table lookup value)	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 9 description	Receiver Channel number and bandwidth of operation of Channel B	
Type (and range)	variable number (1-9999) coding for this channel number follows the “simplex” channel and bandwidth conventions described in ITU-R M.1084, Annex 4	
Maximum number of ASCII characters	4	
Units	None (table lookup value)	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 10 description	Transmitter Channel number and bandwidth of operation of Channel A	
Type (and range)	variable number (1-9999) coding for this channel number follows the “simplex” channel and bandwidth conventions described in ITU-R M.1084, Annex 4	

Detailed Sentence LayoutDescription	Detail	Notes
Maximum number of ASCII characters	4	
Units	none (Table lookup value)	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 11 description	Transmitter Channel number and bandwidth of operation of Channel B	
Type (and range)	variable number (1-9999) coding for this channel number follows the “simplex” channel and bandwidth conventions described in ITU-R M.1084, Annex 4	
Maximum number of ASCII characters	4	
Units	None (table lookup value)	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 12 description	Power level control Base station transmitter Channel A 0 = high power 1 = low power	
Type (and range)	Variable number (0-1)	
Maximum number of ASCII characters	1	
Units	None (table lookup value)	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 13 description	Power level control Base station transmitter Channel B 0 = high power 1 = low power	
Type (and range)	Variable number (0-1)	
Maximum number of ASCII characters	1	
Units	None (table lookup value)	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 14 description	Number of “retries”, used for all addressed messages	
Type (and range)	Variable number (0-3)	
Maximum number of ASCII characters	1	
Units	None	
Special conditional values	None	Note: null indicates no change and/or unavailable
Field 15 description	Message parameter “repeat indicator”	
Type (and range)	Variable number (0-3)	
Maximum number of ASCII characters	1	
Units	None	
Special conditional values	None	Note: null indicates no change and/or unavailable
Field 16 description	Talker Id used by base station	
Type (and range)	string	

Detailed Sentence LayoutDescription	Detail	Notes
Maximum number of ASCII characters	2	
Units	None	
Special conditional values	None	Note: null indicates no change and/or unavailable

D.1.4 CAB – Control AIS Base Station

Detailed Sentence LayoutDescription	Detail	Notes
Recommended sentence formatter	**CAB**	Three alphanumeric characters
Long Sentence Name	Control message for AIS Base stations	
Talker Identifier(s)	AS	AS = AIS Shore Station BS = AIS Base Station
Query Enabled	Yes	Yes or No
Use linked to another sentence formatter	No	Yes or No
Describe linkage	nil	
Multiple line sentence	No	Yes or No
Paragraph describing purpose and use of this sentence	This message is used turn off transmission on/off channel A and B on an AIS base station and also command restart of the base station	
Field 1 description	Command transmission on/off AIS channel A	
Type (and range)	Variable number (0-1) Value of command parameter for channel A 0 = off 1 = on	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 2 description	Command transmission on/off AIS channel B	
Type (and range)	Variable number (0-1) Value of command parameter for channel B 0 = off 1 = on	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 3 description	Restart of base station	
Type (and range)	Fixed number (1) Value of command parameter for restart 1 = restart	
Maximum number of ASCII characters	1	
Units	none	

Detailed Sentence LayoutDescription	Detail	Notes
Special conditional values	none	Note: null indicates no change and/or unavailable

D.1.5 CBM – Configure Base Station Message Reporting Rates

Detailed DescriptionDescription	Detail	Notes
Recommended sentence formatter	CBM	Three alphanumeric characters
Long Sentence Name	Configuration of Base Station message reporting rates	
Talker Identifier(s)	AS	AS = AIS Shore Station BS = AIS Base Station
Query Enabled	Yes	Yes or No
Use linked to another sentence formatter	No	Yes or No
Describe linkage	Nil	
Multiple line sentence		Yes or No
Paragraph describing purpose and use of this sentence	This sentence configures the reporting rates of particular messages that are broadcast by an AIS Base Station. It establishes the broadcast schedule for each frame until changed. The AIS Base Station should apply the information provided by this sentence to autonomously and continuously transmit the VDL messages indicated until revised by a new CBM sentence. This input sentence should be applied to the following AIS VDL messages: 4 (footnote for VDL message 4 in table in paragraph 17.1.3 of document "DraftBaseStationRec_C_V2" must be corrected according to this), 17, 20 and 22. (Reporting rate of VDL message 21 will be set by a separate AtoN sentence – footnote for VDL message 21 in table in paragraph 17.1.3 of document "DraftBaseStationRec_C_V2" must be corrected accordingly) (A diagram showing how this information applies to a frame map would be beneficial for clarity.)	
Field 1 description	Start slot for message 4 broadcasts. The first broadcast will occur on channel A, the second on channel B, and the following broadcasts alternate between the channels A and B through the end of the frame. The increment may vary for details see M.1371-1, Annex 1, 4.2.1, Table 1B and footnote 1 (ref. version of ITU-R M.1371-1 available on ITU WEB site).	
Type (and range)	variable number (-1 to 374)	
Maximum number of ASCII characters	3	
Units	AIS slot number	
Special conditional values	-1 = message 4 not transmitted or discontinued	Note: null indicates no change and/or unavailable
Field 2 description	Start slot for message 17 broadcast on channel A	
Type (and range)	variable number (-1 to 2249)	
Maximum number of ASCII characters	4	
Units	AIS slot number	
Special conditional values	-1 = message 17 not transmitted or current transmissions are discontinued	Note: null indicates no change and/or unavailable
Field 3 description	Increment interval (in slots) between message 17 broadcasts on channel A	
Type (and range)	variable number (1-1125)	
Maximum number of ASCII characters	4	
Units	AIS slots	
Special conditional values	0 indicates only one broadcast in the frame	Note: null indicates no change and/or unavailable

Detailed DescriptionDescription	Detail	Notes
Field 4 description	This field is the number of consecutive slots reserved for each broadcast of message 17 on channel A.	
Type (and range)	variable number (1-4)	
Maximum number of ASCII characters	1	
Units	AIS slots	
Special conditional values	None	Note: null indicates no change and/or unavailable
Field 5 description	Start slot for message 20 broadcast on channel A	
Type (and range)	variable number (-1 to 2249)	
Maximum number of ASCII characters	4	
Units	AIS slot number	
Special conditional values	-1 = message 20 not transmitted or current transmissions are discontinued	Note: null indicates no change and/or unavailable
Field 6 description	Increment interval in slots between message 20 broadcasts on channel A	
Type (and range)	variable number (1-1125)	
Maximum number of ASCII characters	4	
Units	AIS slots	
Special conditional values	0 indicates only one broadcast in the frame	Note: null indicates no change and/or unavailable
Field 7 description	Start slot for message 22 broadcasts on channel A	
Type (and range)	variable number (-1 to 2249)	
Maximum number of ASCII characters	4	
Units	AIS slot number	
Special conditional values	-1 = message 22 not transmitted or discontinued	Note: null indicates no change and/or unavailable
Field 8 description	Increment interval in slots between message 22 broadcasts on channel A	
Type (and range)	variable number (1-1125)	
Maximum number of ASCII characters	4	
Units	AIS slots	
Special conditional values	0 indicates only one broadcast in the frame	Note: null indicates no change and/or unavailable
Field 9 description	Start slot for message 17 broadcast on channel B	
Type (and range)	variable number (-1 to 2249)	
Maximum number of ASCII characters	4	
Units	AIS slot number	
Special conditional values	-1 = message 17 not transmitted or current transmissions are discontinued	Note: null indicates no change and/or unavailable
Field 10 description	Increment interval (in slots) between message 17 broadcasts on channel B	
Type (and range)	variable number (1-1125)	
Maximum number of ASCII characters	4	

Detailed DescriptionDescription	Detail	Notes
Units	AIS slots	
Special conditional values	0 indicates only one broadcast in the frame	Note: null indicates no change and/or unavailable
Field 11 description	This field is the number of consecutive slots reserved for each broadcast of message 17 on channel B.	
Type (and range)	variable number (1-4)	
Maximum number of ASCII characters	1	
Units	AIS slots	
Special conditional values	None	Note: null indicates no change and/or unavailable
Field 12 description	Start slot for message 20 broadcast on channel B	
Type (and range)	variable number (-1 to 2249)	
Maximum number of ASCII characters	4	
Units	AIS slot number	
Special conditional values	-1 = message 20 not transmitted or current transmissions are discontinued	Note: null indicates no change and/or unavailable
Field 13 description	Increment interval in slots between message 20 broadcasts on channel B	
Type (and range)	variable number (1-1125)	
Maximum number of ASCII characters	4	
Units	AIS slots	
Special conditional values	0 indicates only one broadcast in the frame	Note: null indicates no change and/or unavailable
Field 14 description	Start slot for message 22 broadcasts on channel B	
Type (and range)	variable number (-1 to 2249)	
Maximum number of ASCII characters	4	
Units	AIS slot number	
Special conditional values	-1 = message 22 not transmitted or discontinued	Note: null indicates no change and/or unavailable
Field 15 description	Increment interval in slots between message 22 broadcasts on channel B	
Type (and range)	variable number (1-1125)	
Maximum number of ASCII characters	4	
Units	AIS slots	
Special conditional values	0 indicates only one broadcast in the frame	Note: null indicates no change and/or unavailable
Note: When the increment is not 0 the following equation should apply: 2250 MOD increment = 0		

D.1.6 DLM - Data Link Management slot allocations for base station (VDL message 20)

Detailed DescriptionDescription	Detail	Notes
Recommended sentence formatter	DLM	Three alphanumeric characters
Long Sentence Name	Data Link management allocations for base station (AIS VDL message 20)	
Talker Identifier(s)	AS	AS = AIS Shore Station BS = AIS Base Station

Detailed DescriptionDescription	Detail	Notes
Query Enabled	Yes	Yes or No
Use linked to another sentence formatter	No	Yes or No
Describe linkage	nil	
Multiple line sentence		Yes or No
Paragraph describing purpose and use of this sentence	This message is used to reserve FATDMA slots for the use by one or more base stations. This is the information that is broadcast on the VDL using message 20. Reference ITU-R M.1371-1, §3.3.8.2.16 (Also see CBM) Note: A clarification example (diagram?) is needed referencing a couple rules concerning the use and application of this sentence. [To develop rules, see message 20 ITU-R M.1371-1, new field data over writes old data, fields must be filled beginning with field 3, null or "clearing (C)" fields are used to complete sentence.] If an invalid value is entered in a field, the entire sentence is rejected by the base station. Should be in a general description for alarm handling:[Is it necessary for base station to notify the shore station that the sentence was rejected?] Yes The shore station is responsible for filtering out slot reservation conflicts that may exist. These conflicts in the shore station network must be resolved separately from entering the data. The base station is not responsible for detecting these conflicts.	
Field 1 description	sequence number (Like the sequence number method used in the ACA/ACS sentence pair, this number is used to identify and address each "DLM" sentence record stored in the base station.) Note: The sequence number is used to associate the DLM field data with each of the AIS VDL "message 20's" that are broadcast by the base station.	
Type (and range)	variable number (0 - 9)	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 2 description	The Base Station channel for which this sentence's slot reservation information applies. Note that the combination of channels A and B with the sequence number results in 20 possible AIS VDL "message 20" data sets that may be stored in the base station - a maximum of 10 message data sets for each channel.	
Type (and range)	string ("A" or "B")	
Maximum number of ASCII characters	1	
Units	nil	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 3 description	First reservation "ownership" - Indication of shore station ownership for each set of slot reservations; "L" for local, "R" for remote. A base station can broadcast slot reservations for another station. The base station is not allowed to use the slots reserved for stations other than itself. These are the remote (R) stations. It is allowed to broadcast on its own local (L) slots. Final slot selection is a process internal to the base station. The ownership should be subject to be overruled by sentence TBD 2 Rational: Utilise a slot pool used by several base stations.	
Type (and range)	string ("L" or "R")	
Maximum number of ASCII characters	1	
Units	none	

Detailed DescriptionDescription	Detail	Notes
Special conditional values	"C" indicates the current reservation should be removed – leaving this reservation set (Fields 4, 5, 6, 7) empty.	Note: null indicates no change and/or unavailable
Field 4 description	First reservation start slot	
Type (and range)	variable number (0-2249)	
Maximum number of ASCII characters	4	
Units	AIS slot number	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 5 description	First reservation number of slots	
Type (and range)	variable number (1-5 [15]) (See Clarifications Ed. 1.2, ref. ITU-R M.1371-1 §3.3.6.2.16)	
Maximum number of ASCII characters	1	
Units	AIS slots	
Special conditional values	none?	Note: null indicates no change and/or unavailable
Field 6 description	First reservation "time out" (reference M.1371-1, §3.3.4.3.1)	
Type (and range)	variable number (0-7)	
Maximum number of ASCII characters	1	
Units	minutes	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 7 description	First reservation "increment"	
Type (and range)	variable number (0-1125) When the increment is not "0" the following formula should apply: 2250 mod Increment = 0 Rational: To ensure the periodical slot reservation from frame to frame (See ITU-R M.1371, A2,§3.3.4.3.2)	
Maximum number of ASCII characters	4	
Units	AIS slots	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 8 description	Second reservation "ownership" (See Field 3 above)	
Type (and range)	string ("L" or "R")	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values	"C" indicates the current reservation should be removed – leaving this reservation set (Fields 9, 10, 11, 12) empty.	Note: null indicates no change and/or unavailable
Field 9 description	Second reservation start slot	
Type (and range)	variable number (0-2249)	
Maximum number of ASCII characters	4	

Detailed DescriptionDescription	Detail	Notes
Units	AIS slot number	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 10 description	Second reservation number of slots	
Type (and range)	variable number (1-5) (See Field 5 above)	
Maximum number of ASCII characters	1	
Units	AIS slots	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 11 description	Second reservation “time out” (See Field 6 above)	
Type (and range)	variable number (0-7) (See Field 6 above)	
Maximum number of ASCII characters	1	
Units	minutes	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 12 description	Second reservation “increment”	
Type (and range)	variable number (0-1125) (See Field 7 above)	
Maximum number of ASCII characters	4	
Units	AIS slots	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 13 description	Third reservation “ownership” (See Field 3 above)	
Type (and range)	string (“L” or “R”)	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values	“C” indicates the current reservation should be removed – leaving this reservation set (Fields 14, 15, 16, 17) empty.	Note: null indicates no change and/or unavailable
Field 14 description	Third reservation start slot	
Type (and range)	variable number (0-2249)	
Maximum number of ASCII characters	4	
Units	AIS slot number	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 15 description	Third reservation number of slots	
Type (and range)	variable number (1-5) (See Field 5 above)	
Maximum number of ASCII characters	1	
Units	AIS slots	

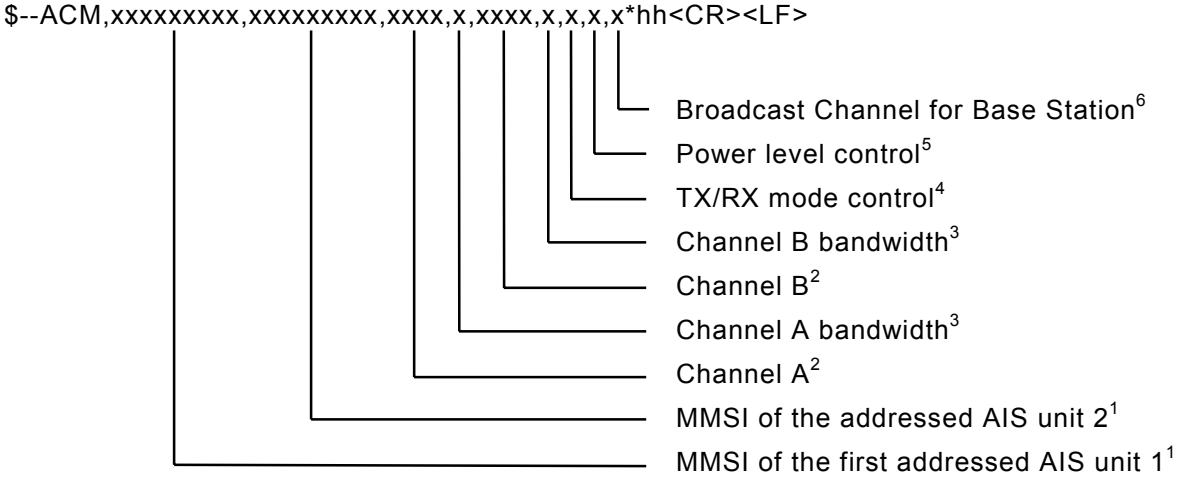
Detailed DescriptionDescription	Detail	Notes
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 16 description	Third reservation “time out” (See Field 6 above)	
Type (and range)	variable number (0-7) (See Field 6 above)	
Maximum number of ASCII characters	1	
Units	minutes	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 17 description	Third reservation “increment”	
Type (and range)	variable number (0-1125) (See Field 7 above)	
Maximum number of ASCII characters	4	
Units	AIS slots	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 18 description	Fourth reservation “ownership” (See Field 3 above)	
Type (and range)	string (“L” or “R”)	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values	“C” indicates the current reservation should be removed – leaving this reservation set (Fields 19, 20, 21, 22) empty.	Note: null indicates no change and/or unavailable
Field 19 description	Fourth reservation start slot	
Type (and range)	variable number (0-2249)	
Maximum number of ASCII characters	4	
Units	AIS slot number	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 20 description	Fourth reservation number of slots	
Type (and range)	variable number (1-5) (See Field 5 above)	
Maximum number of ASCII characters	1	
Units	AIS slots	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 21 description	Fourth reservation “time out” (See Field 6 above)	
Type (and range)	variable number (0-7) (See Field 6 above)	
Maximum number of ASCII characters	1	
Units	minutes	

Detailed DescriptionDescription	Detail	Notes
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 22 description	Fourth reservation “increment”	
Type (and range)	variable number (0-1125) (See Field 7 above)	
Maximum number of ASCII characters	4	
Units	AIS slots	
Special conditional values	none	Note: null indicates no change and/or unavailable

D.2 Proposed IEC 61162-1 Sentences – initial draft

D.2.1 ACM – Preparation and Initiation of An AIS Base Station Broadcast of an Addressed Channel Management Message (ITU-R M.1371 Message 22)

This sentence is used to provide an AIS base station with the information it uses to broadcast an "addressed VDL message 22." This contains settings that are broadcast to one or two specified AIS station(s). Upon receiving this sentence, the base station should prepare and make the appropriate broadcast. (See ITU-R M.1371 Message 22.)



Notes:

1) Identifies the distant addressed AIS unit(s) intended to receive the ITU-R M.1371 message 22. The first MMSI field (field 1) identifies the first AIS unit. The second MMSI field (field 2) identifies the second AIS unit, and may be set to null if only one AIS unit is being addressed.

2) VHF channel number, see ITU-R M.1084, Annex 4.

3) Value of 0, bandwidth is specified by channel number, see ITU-R M.1084, Annex 4
Value of 1, bandwidth is 12.5 kHz

4) Value of 0, transmit on channels A and B, receive on channels A and B
Value of 1, transmit on channel A, receive on channels A and B
Value of 2, transmit on channel B, receive on channels A and B

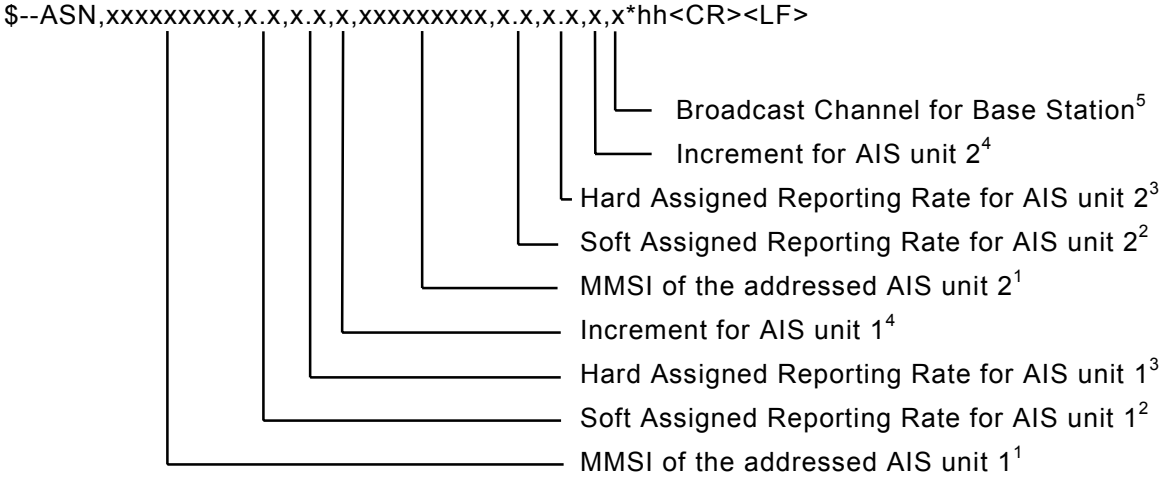
5) Value of 0, high power
Value of 1, low power

6) The field identifies the channel that the base station should use to broadcast the ITU-R M.1371 message 22. A null value in this field indicates no change from previous received value when this sentence is sent to a base station and indicates unknown when this sentence is received from a base station. The values and their meanings are:

Value 0 = No broadcast channel preference
Value 1 = broadcast on AIS channel A
Value 2 = broadcast on AIS channel B
Value 3 = broadcast on both AIS channel A and AIS channel B

D.2.2 ASN – Preparation and Initiation of an AIS Base Station Broadcast of Assignment VDL Message 16.

This sentence is used to provide an AIS base station with the information it uses to broadcast an "assignment VDL message 16." This contains settings that are broadcast to the specified AIS station(s). Upon receiving this information, the base station should prepare and make the appropriate broadcast. (See ITU-R M.1371-1, §3.3.8.1, Message ID 16.)



Notes:

1) Identifies the distant addressed AIS unit(s) for the VDL assignment. The first set of four fields apply to a single AIS unit, while the second set of four fields (fields 5 – 8) apply to a second AIS unit. When only one AIS unit's assignment schedule is being provided, the second set of four fields (fields 5 – 8) may be set to null.

2) This field corresponds to the ITU-R M.1371 Message 16 Offset field. The base station will only use this field if the "Increment for AIS" field (fields 4 and 8 of this sentence) for the same AIS unit is set to zero. The range of values for this field consists of multiples of 20, between and including 20 to 600. Values that are less then 600 but are not multiples of 20 will be interpreted as the next higher multiple of 20. Values above 600 will be interpreted as 600. This field shall be set to null when the "Increment for AIS" field (fields 4 and 8 of this sentence) for the same AIS unit is set to a non-zero value.

3) This field corresponds to the ITU-R M.1371 Message 16 Offset field. The base station will only use this field if the "Increment for AIS" field (fields 4 and 8 of this sentence) for the same AIS unit is set to a non-zero value. The range of values for this field consists 0 to 2249 in units of slots. This field shall be set to null when the "Increment for AIS" field (fields 4 and 8 of this sentence) for the same AIS unit is set to a zero value.

4) This field identifies the increment parameter in units of slots for the associated values of this field. The range of values are from 0 to 6. Note that a value of zero does not provide an increment, see note 2 above. This field shall not be set to null, unless the entire four field set for this AIS unit is not provided, because the base station may invoke two distinctly different assignment methods based on a zero or non-zero value. The values and their meanings are:

   Value 0 = Reporting rate is based upon the "Soft Assigned Reporting Rate for same AIS unit" (fields 2 and 6) / 10 minutes

   Value 1 = 1125 slots

   Value 2 = 375 slots

   Value 3 = 225 slots

   Value 4 = 125 slots

   Value 5 = 75 slots

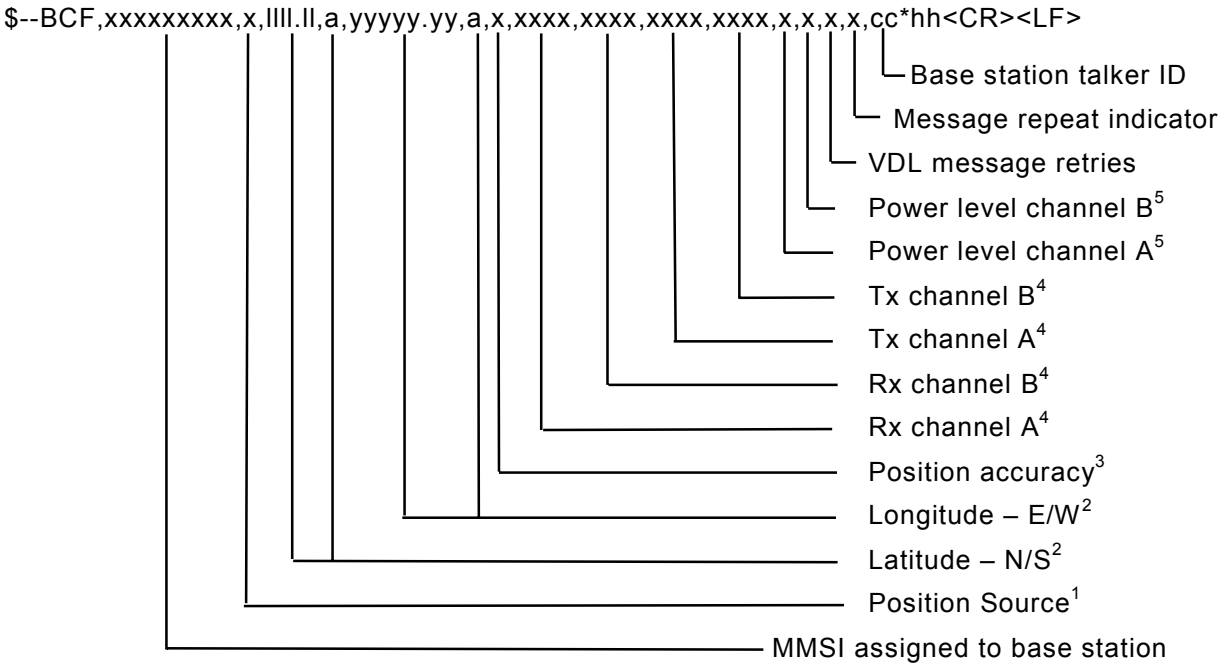
   Value 6 = 45 slots

5) The field identifies the channel that the base station should use to broadcast the ITU-R M.1371 message 16. A null value in this field indicates no change from previous received value when this sentence is sent to a base station and indicates unknown when this sentence is received from a base station. The values and their meanings for this are:

Value 0 = No broadcast channel preference
Value 1 = broadcast on AIS channel A
Value 2 = broadcast on AIS channel B

D.2.3 BCF – Base station Configuration

This sentence is used to configure the static base station parameters when it is initially installed, and later in order to make changes to the way it operates. Dynamic parameters (e.g. UTC and position of a moving base station) are input in a different way. This sentence supports system administration of the AIS base station operation.



Notes:

1) Identifies the source of the position.
Value 0 = surveyed position
Value 1 = internal source
Value 2 = external source

2) Surveyed position of the base station. The position is only applicable to fixed base stations. Within the base station, the “electronic position fixing device” parameter must be set to a value of 7 indicating a surveyed position. Mobile or non-fixed base stations receive their position information by another means.

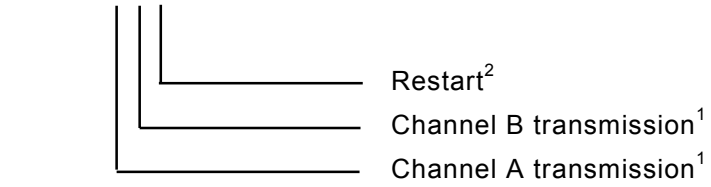
3) 0 = low > 10m.
1 = high < 10m ; differential mode of DGNSS.

4) VHF channel number, see ITU-R M.1084, Annex 4.

5) Value of 0, high power
Value of 1, low power

D.2.4 CAB – Control AIS Base station

This sentence is used turn on or off the transmission of channel A and B on an AIS base station and also to command a restart of the base station. This sentence supports system administration of the AIS base station operation.



Notes:

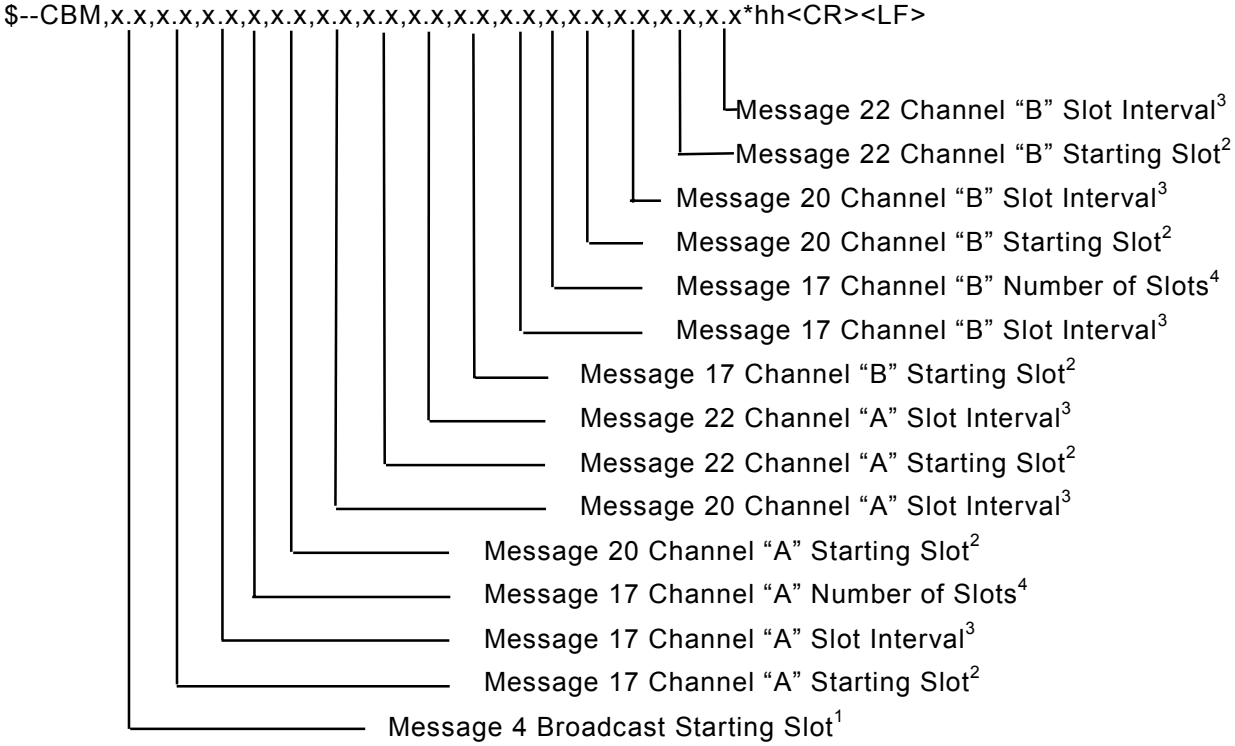
1) The field commands the base station to turn on or off transmissions on the selected channel (fields 1 or 2). There are two valid values for the field. 0 = Off, 1 = On.

2) This field commands the base station to restart operations. The values of “1” indicates a restart. If a restart is not being indicated, this field is null.

D.2.5 CBM –Configure Base Station Message Reporting Rates.

This sentence configures the broadcast schedule of ITU-R M.1371 messages 4, 17, 20 and 22 that are to be broadcast from an AIS Base Station. It establishes the broadcast schedule for each frame until changed. The AIS Base Station should apply the information provided by this sentence to autonomously and continuously transmit the VDL messages indicated until revised by a new CBM sentence. The AIS Base Station, upon receipt of a Query for this sentence, will generate this sentence providing the current broadcast schedule of ITU-R M.1371 messages 4, 17, 20 and 22 to the requestor.

This input sentence should be applied to the following AIS VDL messages: 4 (footnote for VDL message 4 in table in paragraph 17.1.3 of document "DraftBaseStationRec_C_V2" must be corrected according to this), 17, 20 and 22.



Notes:

1) Starting slot ranging from –1 to 374 for ITU-R M.1371 Message 4 broadcasts. The first broadcast will occur on channel A, the second on channel B, and the following broadcasts alternate between the channels A and B through the end of the frame. The increment may vary, see ITU-R M.1371, Annex 1, 4.2.1, Table 1B and footnote 1 for details. A value of –1 discontinues broadcasts of message 4 when the CBM sentence is sent to the AIS equipment, and indicates that no message has been broadcast if the CBM sentence is received from the AIS equipment. A null field indicates no change to the current start slot setting when sent to the AIS equipment, and indicates that the start slot has not been set, i.e. is unavailable, when the CBM sentence is received from the AIS equipment. (ref. version of ITU-R M.1371-1 available on ITU WEB site).

2) Starting slot ranging from -1 to 2249 for ITU-R M.1371 messages 17, 20, or 22, broadcasts on Channels "A" or "B". A value of –1 discontinues broadcasts of the message when the CBM sentence is sent to the AIS equipment, and indicates that no message has been broadcast if the CBM sentence is received from the AIS equipment. A null field indicates no change to the current start slot setting when sent to the AIS equipment, and indicates that the start slot has not been set, i.e. is unavailable, when the CBM sentence is received from the AIS equipment.

3) Slot Interval ranging from 0 to 1125 in slots, between broadcasts of ITU-R M.1371 messages 17, 20, or 22 on Channels "A" or "B". A value of 0 indicates only one broadcast is scheduled in the frame. A null field indicates no change to the current slot interval setting when sent to the AIS equipment, and indicates that the slot interval has not been set, i.e. is unavailable, when the CBM sentence is received from the AIS equipment.

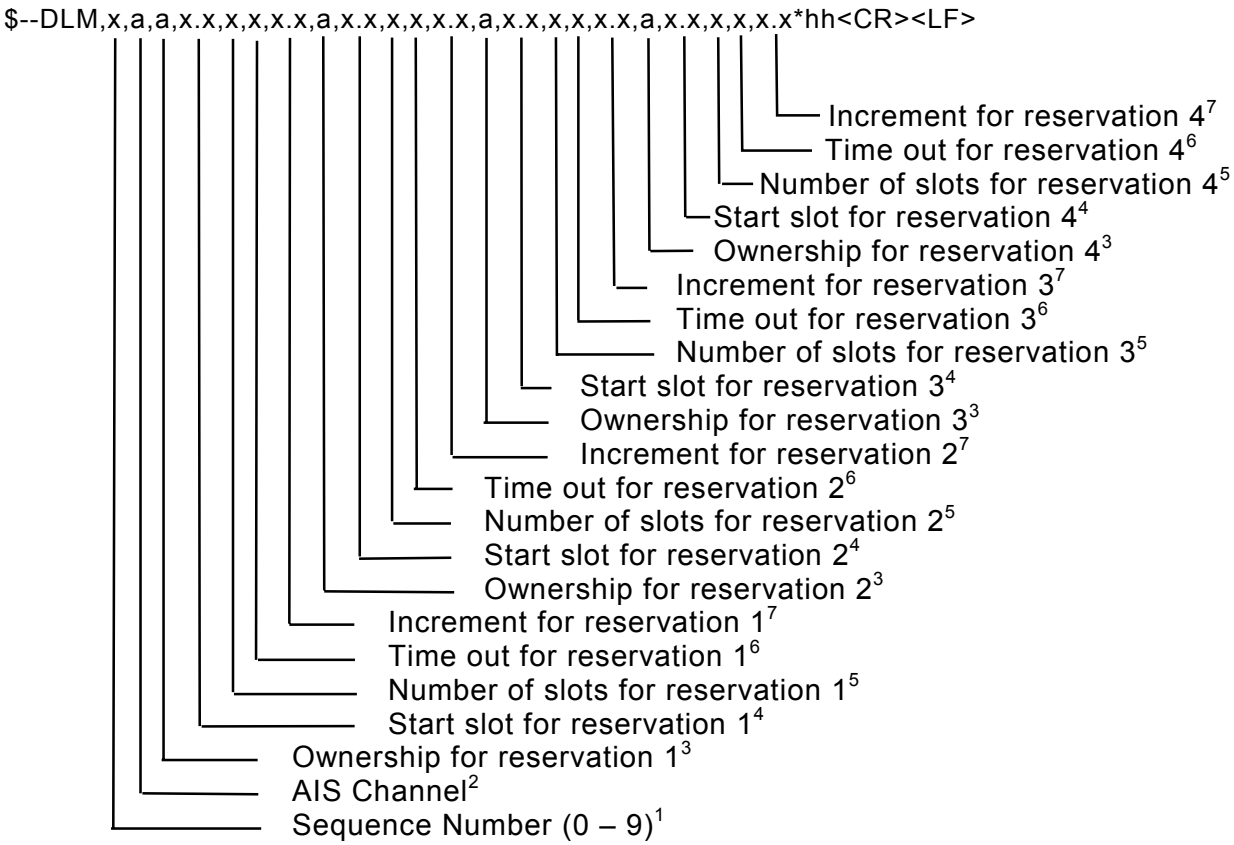
4) The number ranging from 1 to 4 of Consecutive Slots reserved for each broadcast of ITU-R M.1371 message 17 on Channels "A" or "B". A null field indicates no change to the number of consecutive slots

reserved when sent to the AIS equipment, and indicates that the number of consecutive slots has not been set, i.e. is unavailable, when the CBM sentence is received from the AIS equipment.

D.2.6 DLM – Data Link Management slot allocations for base station and mobiles.

This sentence provides the base station with the slot allocations to be reserved for FATDMA base station broadcasts. This sentence provides the base station with the information necessary to broadcast an ITU-R M.1371 Message 20 Data link management message, which informs mobile AIS units of the reserved FATDMA slots. Upon receipt of this sentence the base station will reserve the provided FATDMA slot allocations within it's frame map, and will be ready to generate Message 20 when instructed to do so via the CBM sentence. This is the information that is broadcast on the VDL using message 20. Reference ITU-R M.1371-1, §3.3.8.2.16 (AIso see CBM)

The shore station is responsible for filtering out slot reservation conflicts that may exist. These conflicts in the shore station network must be resolved separately from entering the data. The base station is not responsible for detecting these conflicts. The AIS Base Station, upon receipt of a Query for this sentence, will generate a message consisting of multiple DLM sentences all the FATDMA reserved slots to the requestor.



Notes:

1) From template sequence number (Like the sequence number method used in the ACA/ACS sentence pair, this number is used to identify and address each "DLM" sentence record stored in the base station.)Note: The sequence number is used to associate the DLM field data with each of the AIS VDL "message 20's" that are broadcast by the base station."

2) The AIS Channel that the FATDMA reservation information is to be applied to. The character "A" indicates channel A and "B" indicate channel B. This cannot be a null field when sent to the Base Station. When received from a base station, this field may be null, indicating that no FATDMA slots have been reserved on either channel A or channel B.

3) This field identifies the ownership of the reservation. Possible values are as follows:

L = Local ownership. The base station receiving this sentence owns and may utilize these FATDMA slots. The base station shall broadcast these FATDMA slot reservations.

R = Remote ownership. A remote base station owns and may use these FATDMA slots. The local base station shall broadcast these FATDMA slot reservations.

C = Clear the reservation. This instructs the base station receiving this sentence to clear this reservation from it's frame map. If this field is set to "C", than the following four fields shall be set to null, and will be ignored if set otherwise.

First reservation "ownership" - Indication of shore station ownership for each set of slot reservations; "L" for local, "R" for remote. A base station can broadcast slot reservations for another station. The base station is not allowed to use the slots reserved for stations other than itself. These are the remote (R) stations. It is allowed to broadcast on its own local (L) slots. Final slot selection is a process internal to the base station. The ownership should be subject to be overruled by sentence TBD 2 Rational: Utilise a slot pool used by several base stations.

4) Starting slot ranging from 0 to 2249. A null field indicates no change to the staring slot for this FATDMA reservation. When received from a base station, a null field indicates that the start slot has not been set, i.e. is unavailable, when the DLM sentence is received from the AIS equipment.

5) The number ranging from 1 to 5 of Consecutive Slots reserved for FATDMA broadcasts. A null field indicates no change to the number of consecutive slots reserved when sent to the AIS equipment, and indicates that the number of consecutive slots has not been set, i.e. is unavailable, when the DLM sentence is received from the AIS equipment.

6) The Time out in minutes ranging from 0 to 7 for the Slots reserved for FATDMA broadcasts. A null field indicates no change to the number of consecutive slots reserved when sent to the AIS equipment, and indicates that the number of consecutive slots has not been set, i.e. is unavailable, when the DLM sentence is received from the AIS equipment.

7) Slot increment ranging from 0 to 1125 in slots. A value of 0 indicates only one broadcast is scheduled in the frame. A null field indicates no change to the current slot increment setting when sent to the AIS equipment, and indicates that the slot increment has not been set, i.e. is unavailable, when the DLM sentence is received from the AIS equipment. When the increment is not "0" the following formula should apply:

2250 mod Increment = 0

Rationale: To ensure the periodical slot reservation from frame to frame (See ITU-R M.1371, A2,§3.3.4.3.2)

Annex E
(informative)
Format definition of optional input / output sentences specifically defined for AIS base stations in accordance with the data structures of IEC 61162-1

E.1 BOC - Base station options configuration

Description	Detail	Notes
Recommended sentence formatter	**BOC**	Three alphanumeric characters
Long Sentence Name	Base Station Options Configuration	
Talker Identifier(s)	AS	AS = AIS Shore Station BS = AIS Base Station
Query Enabled	yes	Yes or No
Use linked to another sentence formatter	no	Yes or No
Describe linkage	nil	
Multiple line sentence	no	Yes or No
Paragraph describing purpose and use of this sentence	This sentence is used to configure the optional output of a particular Base Station	
Field 1 description	MMSI of the Base Station	
Type (and range)	Fixed number field (10 digits)	
Maximum number of ASCII characters	10	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 2 description	Received field strength for each message 0 = no output 1 = continuous output 2 = output next frame only	
Type (and range)	Variable number (0-2)	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values		Note: null indicates no change and/or unavailable
Field 3 description	First slot number of each received message 0 = no output 1 = continuous output 2 = output next frame only	
Type (and range)	Variable number (0-2)	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values		Note: null indicates no change and/or unavailable
Field 4 description	signal-to-noise-ratio for each message 0 = no output 1 = continuous output 2 = output next frame only	
Type (and range)	Variable number (0-2)	

Description	Detail	Notes
Maximum number of ASCII characters	1	
Units	none	
Special conditional values		Note: null indicates no change and/or unavailable
Field 5 description	current channel load ratio Channel A 0 = no output 1 = continuous output 2 = output next frame only	
Type (and range)	Variable number (0-2)	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values		Note: null indicates no change and/or unavailable
Field 6 description	current channel load ratio Channel B 0 = no output 1 = continuous output 2 = output next frame only	
Type (and range)	Variable number (0-2)	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values		Note: null indicates no change and/or unavailable
Field 7 description	hardware and software version information used in AIS base station 0 = no output 1 = single interrogation	
Type (and range)	Variable number (0-1)	
Maximum number of ASCII characters	1	
Units	none	
Special conditional values		Note: null indicates no change and/or unavailable

E.2 BRM - Base station options reply of received messages

Description	Detail	Notes
Recommended sentence formatter	**BRM**	Three alphanumeric characters
Long Sentence Name	Base Station Options Reply of Received Messages	
Talker Identifier(s)	BS	AS = AIS Shore Station BS = AIS Base Station
Query Enabled	yes	Yes or No
Use linked to another sentence formatter	no	Yes or No
Describe linkage		
Multiple line sentence	no	Yes or No
Paragraph describing purpose and use of this sentence	This sentence will give optional information of a received Message of a Base Station. The output sentence of the received Message (VDM) must be just before this sentence	
Field 1 description	MMSI of the Base Station	

Description	Detail	Notes
Type (and range)	Fixed number field (10 digits)	
Maximum number of ASCII characters	10	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 2 description	MMSI of previous received message	
Type (and range)	Fixed number field (10 digits)	
Maximum number of ASCII characters	10	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 3 description	Received field strength of previous received message	
Type (and range)	variable number (0- -xxx) 0 = not available or not required	
Maximum number of ASCII characters	4	
Units	dBm	
Special conditional values		Note: null indicates no change and/or unavailable
Field 4 description	First slot number of previous received message	
Type (and range)	variable number (0- 2249) 9999 = not available or not required	
Maximum number of ASCII characters	4	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 5 description	signal-to-noise-ratio of previous received message	
Type (and range)	variable number (0- xx) 0 = not available or not required	
Maximum number of ASCII characters	2	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable

E.3 BRF - Base station options reply of frame information

Description	Detail	Notes
Recommended sentence formatter	**BRF**	Three alphanumeric characters
Long Sentence Name	Base Station Options Reply of Frame information	
Talker Identifier(s)	BS	AS = AIS Shore Station BS = AIS Base Station
Query Enabled	yes	Yes or No
Use linked to another sentence formatter	no	Yes or No

Description	Detail	Notes
Describe linkage	nil	
Multiple line sentence	no	Yes or No
Paragraph describing purpose and use of this sentence	This sentence can give the use of the VDL per channel for each Frame. Sentence is output once per Frame after completion of the Frame	
Field 1 description	MMSI of the Base Station	
Type (and range)	Fixed number field (10 digits)	
Maximum number of ASCII characters	10	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 2 description	Current Channel Load Ratio channel A	
Type (and range)	Fixed number field	
Maximum number of ASCII characters	3	
Units	%	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 3 description	Current Channel Load Ratio channel B	
Type (and range)	Fixed number field	
Maximum number of ASCII characters	3	
Units	%	
Special conditional values		Note: null indicates no change and/or unavailable
Field 4 description		
Type (and range)		
Maximum number of ASCII characters		
Units		
Special conditional values		Note: null indicates no change and/or unavailable
Field 5 description		
Type (and range)		
Maximum number of ASCII characters		
Units		
Special conditional values		Note: null indicates no change and/or unavailable
Field 6 description		
Type (and range)		
Maximum number of ASCII characters		
Units		
Special conditional values		Note: null indicates no change and/or unavailable

E.4 VER - Version

Description	Detail	Notes
Recommended sentence formatter	**VER**	Three alphanumeric characters
Long Sentence Name	Version	
Talker Identifier(s)	BS	AS = AIS Shore Station BS = AIS Base Station
Query Enabled	yes	Yes or No
Use linked to another sentence formatter	no	Yes or No
Describe linkage	nil	
Multiple line sentence	no	Yes or No
Paragraph describing purpose and use of this sentence	This sentence can give the version of the hardware and software of a not mobile AIS station. Also the manufacturer and the type of the equipment is given.	
Field 1 description	MMSI of the AIS station	
Type (and range)	Fixed number field (10 digits)	
Maximum number of ASCII characters	10	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 2 description	Type of AIS station	
Type (and range)	String BS = Base Station LBS = Limited Base Station SRS = Simplex Repeater Station DRS = Duplex Repeater Station	
Maximum number of ASCII characters	3	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 3 description	Manufacturer Identifier	
Type (and range)	string	
Maximum number of ASCII characters	4	
Units	none	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 4 description	Manufacturers Serial Number, AIS unit UNIQUE serial number	
Type (and range)	Variable number (0-262143)	
Maximum number of ASCII characters	6	
Units	None	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 5 description	Model Code	
Type (and range)	Variable number (0-4095)	
Maximum number of ASCII characters	4	

Description	Detail	Notes
Units	None	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 6 description	Software revision	
Type (and range)	string	
Maximum number of ASCII characters	2	
Units	None	
Special conditional values	none	Note: null indicates no change and/or unavailable
Field 7 description		
Type (and range)		
Maximum number of ASCII characters		
Units		
Special conditional values		Note: null indicates no change and/or unavailable
Field 8 description		
Type (and range)		
Maximum number of ASCII characters		
Units		
Special conditional values		Note: null indicates no change and/or unavailable
Field 9 description		
Type (and range)		
Maximum number of ASCII characters		
Units		
Special conditional values		Note: null indicates no change and/or unavailable
Field 10 description		
Type (and range)		
Maximum number of ASCII characters		
Units		
Special conditional values		Note: null indicates no change and/or unavailable
Field 11 description		
Type (and range)		
Maximum number of ASCII characters		
Units		
Special conditional values		Note: null indicates no change and/or unavailable
Field 12 description		
Type (and range)		
Maximum number of ASCII		

Description	Detail	Notes
characters		
Units		
Special conditional values		Note: null indicates no change and/or unavailable
Field 13 description		
Type (and range)		
Maximum number of ASCII characters		
Units		
Special conditional values		Note: null indicates no change and/or unavailable
Field 14 description		
Type (and range)		
Maximum number of ASCII characters		
Units		
Special conditional values		Note: null indicates no change and/or unavailable

_____